ONTARIO MINISTRY OF ENVIRONMENT
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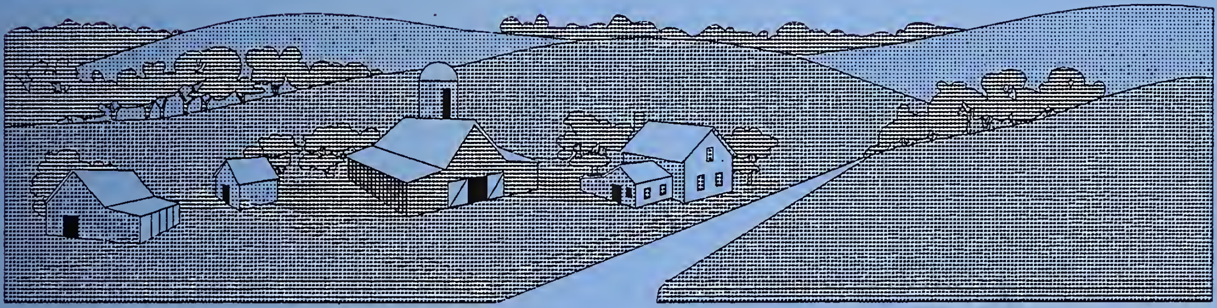
CLEAN UP RURAL BEACHES

(CURB) PLAN

For the Spencer Creek

Watershed



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Clean up rural beaches plan
(CURB) for the Spencer Creek
watershed / Gale, David.

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FOREWORD

This report is one of a series produced under the Provincial Rural Beaches Program. The objective of the program was to identify the relative impact of pollution sources, and develop a course of action leading to the restoration and long term maintenance of acceptable water quality at provincial rural beaches.

Significant enrichment and bacterial contamination in southern Ontario rivers and lakes originates from rural sources. The discharge of waste material to streams can result in elevated bacterial concentrations, nuisance algae blooms, fish kills, and present a potential health hazard to humans and livestock using the water. Watershed studies have found that a multitude of pollution sources and pathways may affect beaches in Ontario. These include:

1) Urban sanitary and stormwater runoff,
2) Direct livestock manure access to watercourses,
3) Inadequate manure management practices,
4) Direct discharge of milkhouse wastes,
5) Contaminated field tile systems, and
6) Faulty septic systems.

The impact upon beaches of these sources, either singly or in combination, can range from a few days of elevated concentrations to complete seasonal closures.

Numerous beach closings in 1983 and 1984, drew public and government attention to the severity of this water quality problem. In 1985, the Ontario Ministry of the Environment and Energy's (MOEE) Water Resources Branch formulated the Provincial Rural Beaches Strategy Program. Directed by the Provincial Rural Beaches Planning and Advisory Committee, it included representatives from Ministry of Environment and Energy (MOEE), Ministry of Agriculture, Food and Rural Affairs (OMAFRA), and Ministry of Natural Resources (MNR).

With financial and technical assistance from the MOEE, local Conservation Authorities carried out studies under the direction of a local technical steering committee. Chaired by an MOEE regional staff, the committees typically included representation from OMAFRA, MNR, the Medical Officer of Health, Conservation Authority, the local federation of Agriculture, and a local farmer. The chairs of the local committees assured communication between all the projects by participating on the Provincial Committee.

The primary objective of each local study was to identify the relative impact of pollution sources, their pathways to beaches, and to develop a Clean Up Rural Beaches (CURB) plan specific to the watershed upstream of each beach. The CURB plan develops remedial strategy options and respective cost estimates for each beach through:

1) Field inspections,
2) Farmer consultations,
3) Water quality monitoring, and
4) Basic mathematical modelling techniques.

Recommended actions include both measures for specific beaches and broader scale Provincial measures based on cumulative results of component studies.

The following related research projects were also MOEE funded and undertaken by various Conservation Authorities to improve our understanding of bacterial and nutrient dynamics:

1) Insitu bacterial survival studies determined longevity: in watercourses, offshore of beaches, in sediments, and in milkhouse washwater tiles.

2) Biotracer studies determined the speed and nature of travel for bacteria introduced into a watercourse.

3) A liquid manure spreading study examined bacterial movements through the soil column and exiting field tile drains.

4) A target sub-basin study evaluated the effectiveness of comprehensive remedial measure upon a watershed.

Numerous demonstration farms have been established with the cooperation of local farmers to display innovative management practices. Research continues on their effectiveness at improving water quality.

Comments and/or questions on this report are welcome. Please send written comments to:

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HAMILTON REGION CONSERVATION AUTHORITY

CLEAN UP RURAL BEACHES PLAN

(CURB)

SPENCER CREEK WATERSHED

CLEAN UP RURAL BEACHES PLAN

(CURB)

FOR THE SPENCER CREEK WATERSHED

HAMILTON REGION CONSERVATION AUTHORITY

Prepared by: David Gale

Prepared for: The Ontario Ministry of Environment and Energy

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Field data for the Hamilton Region Conservation Authority's Rural Beaches Program was collected by staff. The field samples were analyzed by laboratory staff of the Ministry of Environment and Energy.

The author also would like to express his gratitude to the staff of the Hamilton Region Conservation Authority, Planning and Engineering Department, for the assistance and information provided throughout the study.

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1993 Results,

EXECUTIVE SUMMARY

During the mid 1970s and 1980s, the deterioration in water quality in Spencer Creek and the Christie and Valens Conservation Area reservoirs became a concern to the Hamilton Region Conservation Authority (HRCA). In 1993 the HRCA applied to the Ministry of Environment and Energy(MOEE) for funding from the Provincial Clean Up Rural Beaches Program (CURB) to study surface water quality in the Spencer Creek watershed. watershed and

Spencer Creek Watershed

The object of the HRCA CURB study was to identify and quantify sources of bacterial pollution that were impairing water quality at the Christie and Valens reservoirs. Working in cooperation with the Halton Region Conservation Authority, an extensive water quality monitoring program, stream surveys, field assessments and land owner interviews were conducted in the summer of 1993. Approximately 325 water samples were taken. Over 150 landowners were identified in the watershed and some 30 agricultural operators interviewed. These programs revealed several contributors to the bacterial pollution at the beaches, including runoff from barnyards and manure stacks, unrestricted livestock access to the watercourse, untreated disposal of milkhouse washwater, inadequate private sewage treatment systems and natural sources.

swimming area

The HRCA CURB model was developed to predict the total seasonal faecal coliform bacterial loads delivered to the Spencer Creek watercourse and to the Christie and Valens reservoirs. Barnyard runoff and improper manure storage, inappropriate milkhouse washwater disposal, livestock access and faulty septic systems were the four highest contributors of bacteria to the beach. The HRCA CURB model predicted that a total seasonal bacterial load of 1.46×10^{13} EC was being delivered to Christie reservoir from all upstream sources while a total seasonal bacterial load of 1.79×10^{12} EC was being delivered to Valens reservoir from all upstream sources.

To improve water quality within the watershed, the HRCA CURB plan recommends remedial measures to reduce bacterial inputs. A 60 percent reduction in the load delivered from the watershed to the beach area was established as a target. Total preliminary costs for all remedial programs for the watershed were estimated at $200,500.00 for some 30 projects. page.

Milkhouse washwater treatment systems were identified as the most cost-effective remedial measure for Christie reservoir, with an estimated cost of approximately $15,000.00. Runoff containment from stacks and yards was predicted to be the second most cost-effective remedial measure for Christie reservoir, with an estimated cost of $40,000.00. Next was upgrading private septic systems with an estimated cost of $25,000.00. The least cost-effective remedial measure was restricting livestock access to the watercourse, projected to cost some $70,000.00.

For Valens reservoir, runoff containment from manure stacks and barnyards was identified as the most cost-effective remedial measure, with an estimated cost of approximately $20,000.00. Milkhouse washwater treatment was predicted to be the second most cost effective remedial program, costing some $5,000.00. Finally restricting livestock access to the watercourse was projected to cost approximately $25,500.00. No failing private septic systems were identified upstream of Valens reservoir.

Based on the small size of the watershed and potential impact on the beach areas, it is recommended that the remedial measures be systematically implemented throughout the study area. Ongoing water quality monitoring will evaluate the effectiveness of remedial programs. The cooperation of government ministries, agencies and the private sector will be required to reduce bacterial pollution to the watercourse. Program delivery by the HRCA would be provided under the direction of a multi-agency steering committee. The program would offer educational, financial and technical assistance to watershed residents. This effort would promote alternate land management practices that could achieve improvement in surface water quality.

INTRODUCTION

1.1 PROGRAM HISTORY

High bacteria counts have been a problem at rural beaches throughout Ontario since the early 1980s. In an attempt to address the public's concern over this matter, the Ministry of Environment and Energy (MOEE) announced its Provincial Rural Beaches Strategy Program (RBP). The purpose of the program was to investigate the impact of rural land use practices on the water quality of streams that feed into beach areas by providing technical and financial help to local Conservation Authorities.

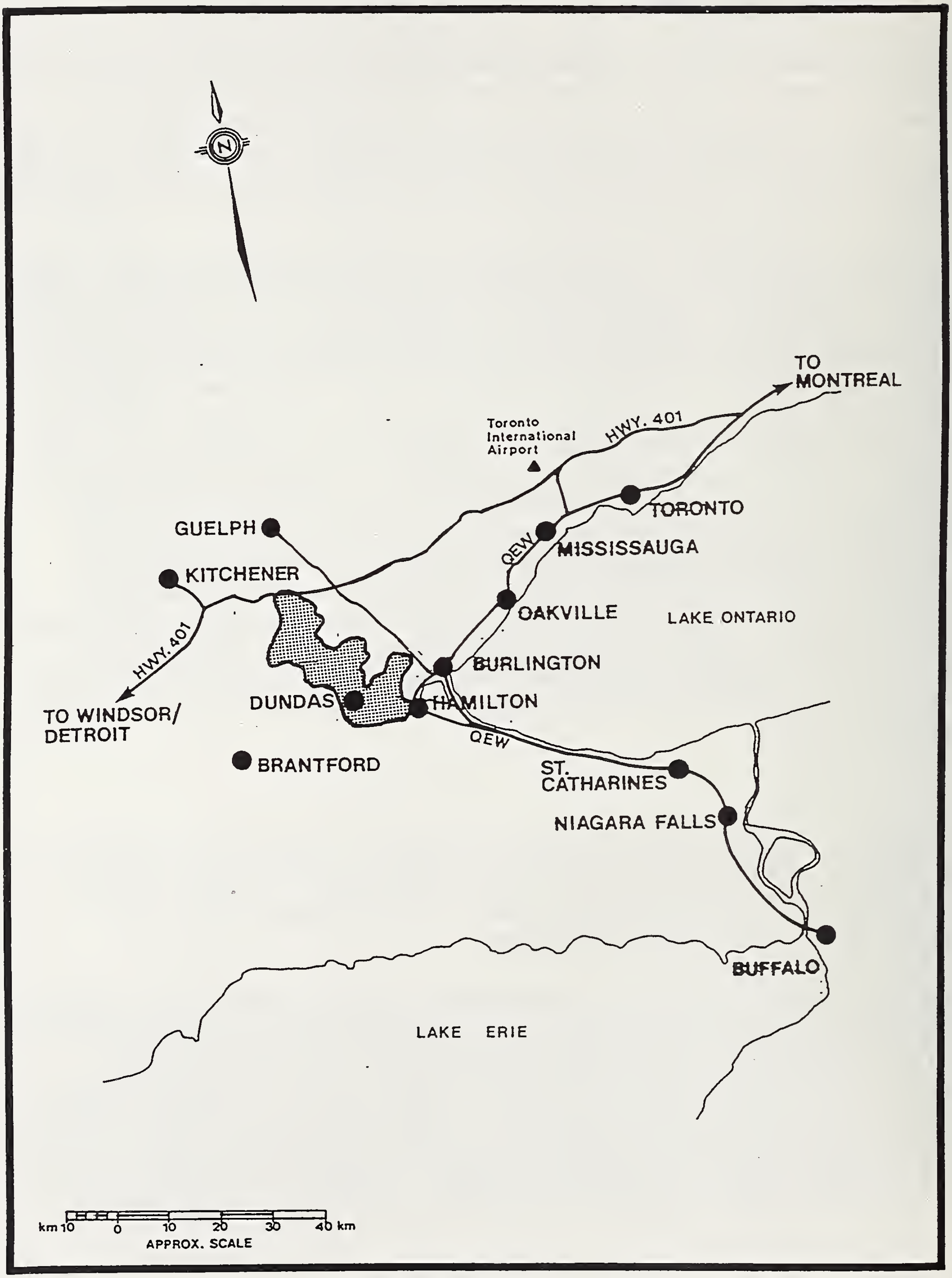
The Hamilton Region Conservation Authority (HRCA) operates swimming beaches at Valens and Christie Conservation Area on Spencer Creek (Figure 1.3.2). The beaches are important recreational swimming areas for area residents during the summer. Water quality at these beaches became a concern to the HRCA in the 1970s when testing recorded water quality parameters unacceptable for swimming. Eventually, curtains and chlorination systems were installed in the reservoirs to provide acceptable water quality. As the amount and the cost of the systems increased, the HRCA began to investigate alternate solutions to water quality problems. In 1992, the HRCA applied for funding from the Ministry of Environment and Energy under the Provincial Clean Up Rural Beaches Program(CURB) to study the water quality of Spencer Creek and affect improvements. However due to Provincial funding constrictions, the MOEE suggested that the HRCA utilize the expertise available at the adjacent Halton Region Conservation Authority. Since the Halton Region Conservation Authority was already participating in the CURB program and had the staff, equipment and experience necessary to conduct the study, an agreement was reached whereby the two Authorities would cooperate and conduct the study jointly. Based on the study results, the Hamilton Conservation Authority could then apply to participate in the implementation phase of the CURB program.

1.2 OBJECTIVES

The primary objective of the HRCA Clean Up Rural Beaches Program was to identify the sources and extent of bacterial pollution stemming from agricultural operations and rural residences, as well as from natural inputs. This was achieved through water quality monitoring, field studies and land owner surveys.

This report presents the Hamilton Region Conservation Authority's Clean Up Rural Beaches (CURB) Plan, which predicts the pollution impact on Spencer Creek from various sources. It includes an implementation strategy and recommendations for cost-effective remedial measures aimed at reducing bacterial pollution at the point of origin. The long term goal of the plan is to improve water quality throughout the Spencer Creek watershed and to enable the Christie and Valens reservoirs to be utilized as natural swimming areas without artificial chemical treatment systems or frequent beach closures. Ultimately, it is to be hoped that the study will serve as a guide to improve water quality in all of the HRCA's rural watersheds.

FIGURE 1.3.1
Location of the Study Area



1.3 PROGRAM STUDY AREA

The study area is located centrally in the western portion of the Regional Municipality of Hamilton Wentworth on the Niagara Escarpment, and lies primarily within the Town of Flamborough(Figure 1.3.1). The study focused on the Spencer Creek watershed upstream of the Christie dam, and was directed at investigating those pollution sources affecting the Valens and Christie swimming beaches.

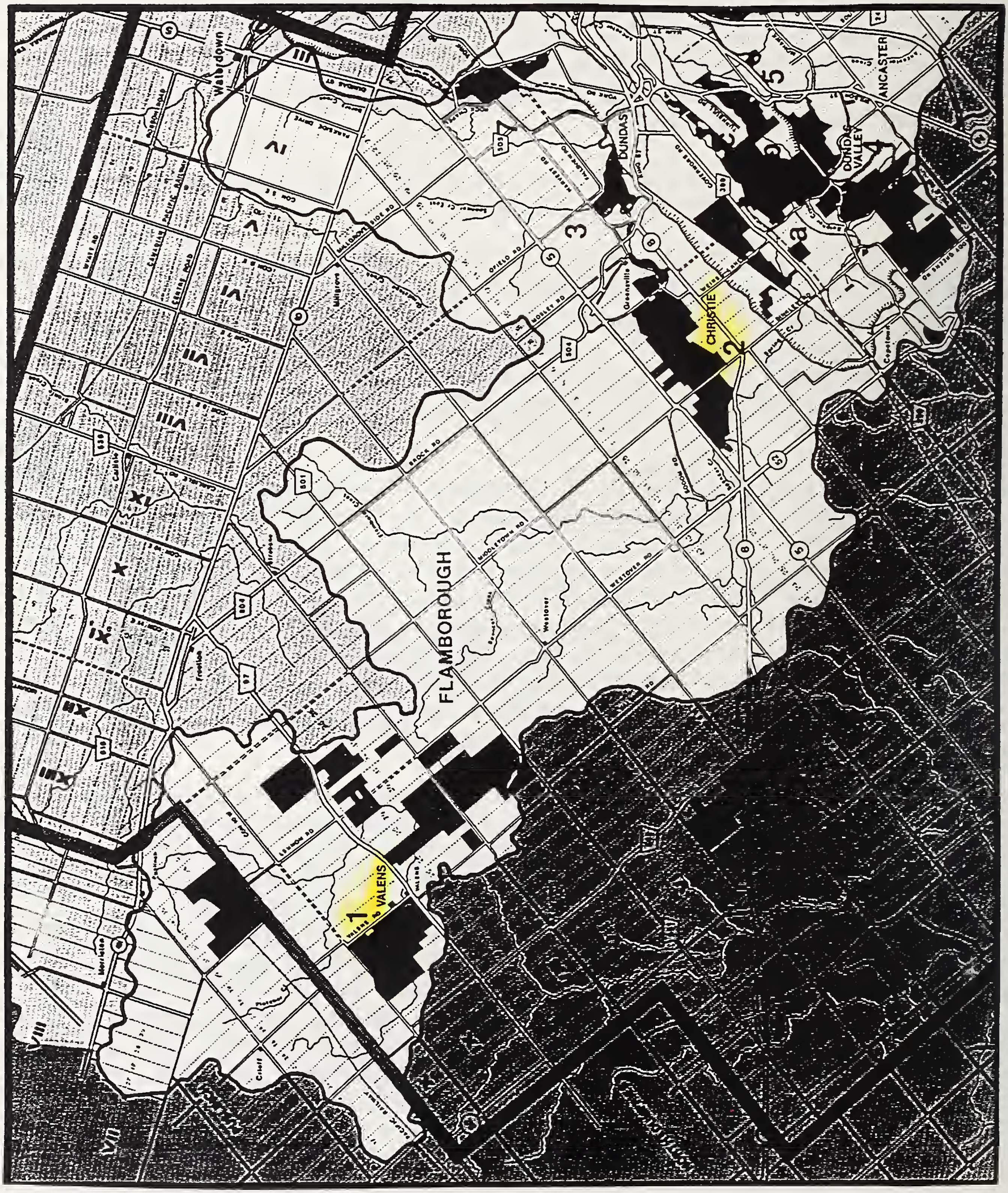
The following description of the watershed was taken from the 1990 Spencer Creek Watershed Hydrology Report by MacLaren Plansearch.

In addition to its extensive drainage pattern, the Spencer Creek basin is also characterized by wetland, rural land use and scattered communities in the upper part of the basin while urban developments predominate in the lower part of the watershed. It has a total length along its main channel of about 40 km excluding the Desjardins Canal. The headwaters are located in the springs and seepage areas of the Galt Moraine within Puslinch Township. From an elevation of about 340 m it flows in a southeast direction into the Valens reservoir, near the community of Valens.

The main branch is joined by Fletcher Creek downstream of Region Road 97. A significant feature of the Spencer Creek watershed at this location is the Beverley Swamp, designated by the OMNR as a class 1 wetland, an ESA and one of 40 Carolinian Canada sites in the province. It occupies an area of 20 km^2 and is characterized by an area of low relief. Above Regional Road 97 the stream gradient is fairly steep with an average slope of 3.1 m/km. However, from the Beverley Swamp south to Greensville, the slopes of the main channel and its' tributary streams are fairly low. The average slope for this portion of the watershed is about 1.9m/km. Throughout the watershed, several small concrete dams and weirs have been constructed, and except for localized siltation and some warming, water quality would not appear to have been significantly impaired

The majority of the watershed is underlain by light grey to brown, buff-weathered dolomite of the Guelph formation. In the headwaters area, soils are dominated by light brown loam and stony tills associated with the Galt moraine and drumlinized region north of the hamlet of Westover. The high sand and gravel contents of this till indicate it has probably undergone considerable reworking by water. Most of the steep-sided drumlins are intensively cultivated since they contain loamy well-drained soils. As a result of the weather resistant bedrock and shallow soils which become increasingly bouldery, much of the headwaters region of the study area to the north has retained its natural vegetation. Soil deposits between the drumlins are often shallow and stony with large areas of shallow muck swamps. The Beverley Swamp is the largest of these. South of the community of Westover a variety of sandy loams with varied textures tend to dominate (Presant et al., 1968). The majority of agricultural operations within the study area are found south of the 7th Concession on the well-drained loams.

FIGURE 1.3.2
Study Area Watershed



The Spencer Creek watershed lies within two of the climatic regions defined by Putnam and Chapman as the South Slopes and the Lake Erie Counties Region (Putnam & Chapman, 1984). The majority of the study area lies within the former region. Though the South Slopes region is climatically less severe than areas further north, the Lake Erie Counties Region is favoured because of the greater distance from the lakes and their modifying influences. The mean annual temperatures range from 6^0C to 7^0C, while the precipitation averages 785 mm of which 155 mm to 175 mm comes as snow. The frost-free season is about 147 days and the growing season averages about 196 days. The watershed averages between 100 and 125 rainy days per year where precipitation averages 2 mm or more.

1.3.1 Christie Reservoir Beach

Spencer Creek is regulated just upstream of Greensville by the Christie dam and reservoir, constructed in 1971 by the HRCA as a multipurpose reservoir, including flood control for the Town of Dundas. The 336 hectare Christie Conservation Area's reservoir is also used for low flow augmentation and water-based recreation (Figure 1.3.3). The surrounding woodlands and grass fields are highly suited to compatible passive recreational activities. Summer activities revolve around the reservoir with its sand swimming beach and surrounding parklands. The Christie reservoir beach is one of the two CURB study beaches. The chlorinated swimming area is 350 m long and 30 m wide and has a capacity for 6000 bathers. It has a vinyl coated, nylon curtain to separate it from the rest of the reservoir during the summer. Chlorination begins in early June. Water is chlorinated in a facility where gaseous chlorine is injected before the water is redistributed. In 1993 approximately 6 tonnes of chlorine were used to maintain acceptable water quality. A monofilament bird screen has been erected above the beach area to deter gulls and geese, and thus reduce the risk of bacterial contamination from that source.

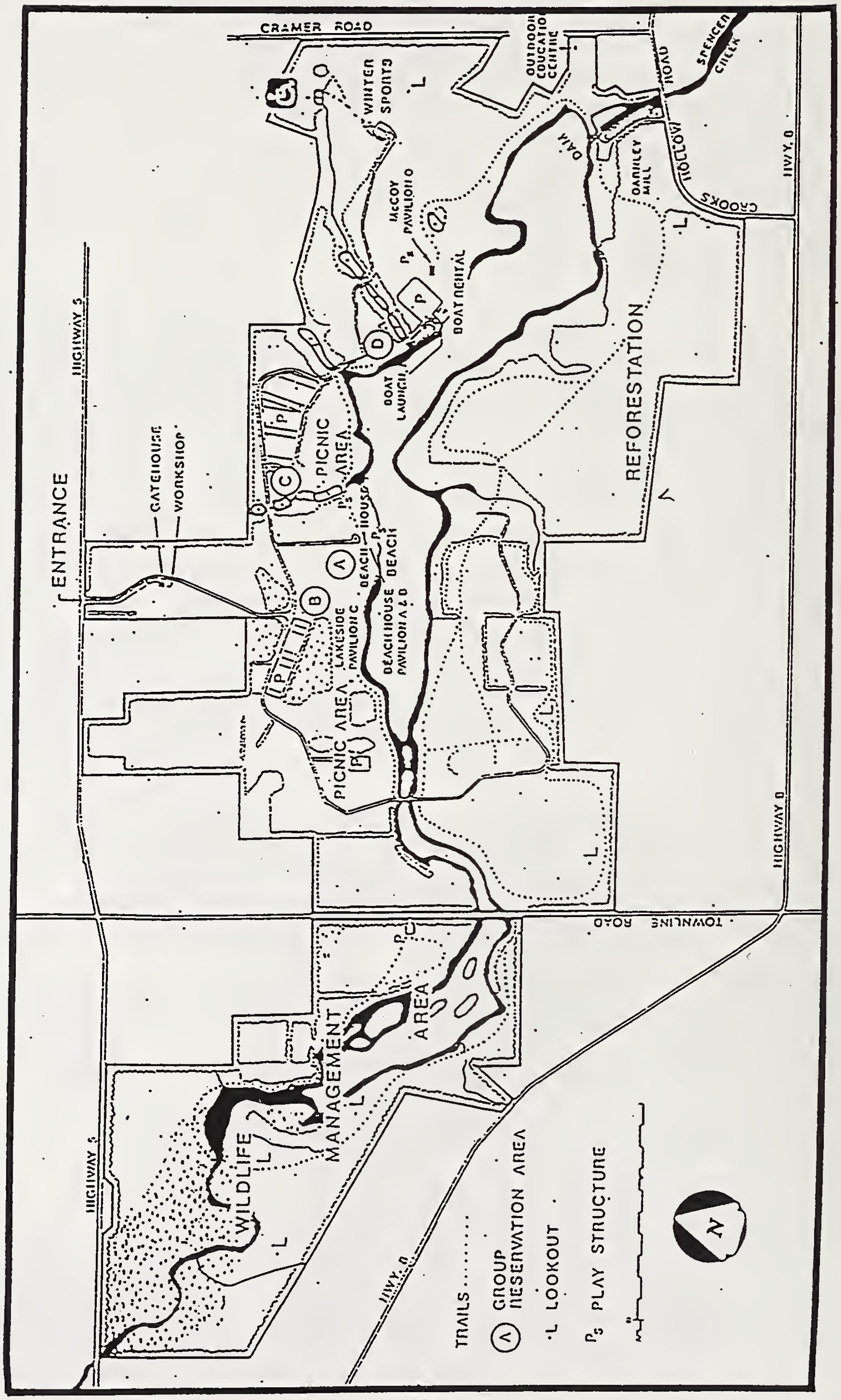
Tests by the Regional Health Unit confirm that while the water quality inside the swimming area is acceptable for bathers, outside the curtain the water is unacceptable for water contact recreation. The swimming area is used by about 50% of the visitors to Christie Conservation Area. In a typical summer total attendance is approximately 117,000.

The watercourse above Christie dam drains an area of approximately 150 km^2. According to MacLaren Plansearch (1990), land use upstream includes:

Pasture	4915.0 ha
Small grains	3938.8 ha
Row crops	2418.6 ha
Woodlots	3072.8 ha
Wetland	197.2 ha
Urban	158.1 ha

Livestock operations, including dairy, beef, swine and poultry, and cash cropping predominate.

FIGURE 1.3.3
Christie Reservoir and Swimming Area



1.3.2 Valens Reservoir Beach

Approximately 14 kilometres upstream of the Christie reservoir is the Valens Conservation Area with its 61 hectare multipurpose reservoir(Figure 1.3.4), the site of the other CURB study beach. The Valens dam and reservoir were constructed in 1968 by the HRCA primarily for low flow augmentation, but with the objective of reducing downstream flooding during the spring runoff. The reservoir is used for swimming, non-power boating and fishing. The surrounding 284 hectare property has facilities for camping, picnicking, nature observing, hiking and the like. The swimming area is about 200 m by 30 m and has a capacity for 2,500 bathers. It is separated from the rest of the reservoir by a vinyl coated, nylon curtain during the summer swimming season. The water is pumped to a chlorination facility where gaseous chlorine is added and pumped back to the swimming area. About 2.2 tonnes of chlorine are used annually. The curtain and chlorination system were installed in 1976 after several years of water quality problems primarily related to parasites from waterfowl.

The water is tested by the Regional Health Unit and occasional high bacterial readings occur within the main reservoir. These high readings are usually associated with rainfall events. Each summer Canada Geese in eclipse plumage are rounded up and transported away from Valens to reduce their impact on the reservoir and surrounding parkland.

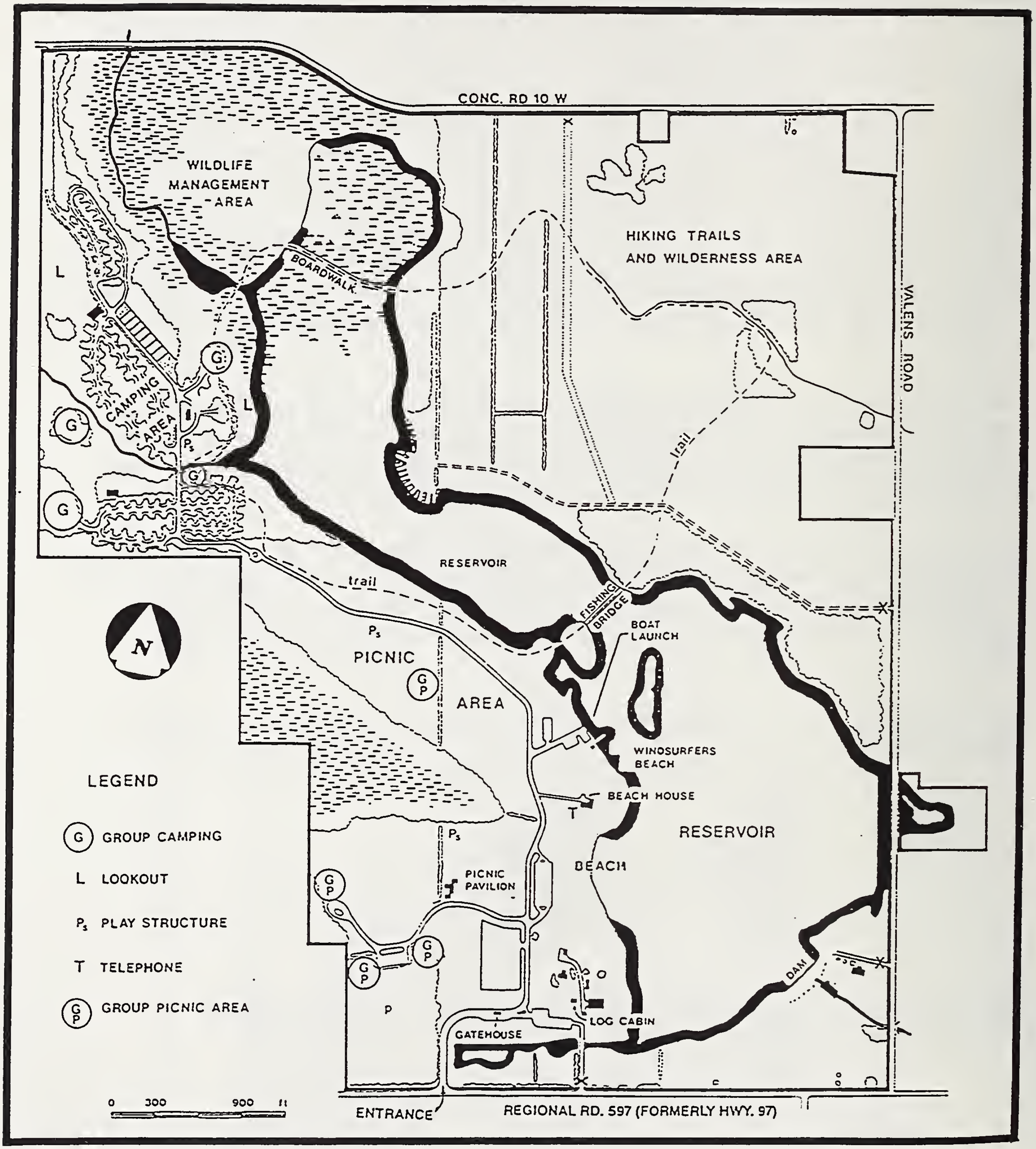
About 100,000 people visit Valens Conservation Area annually and of these some 65,000 use the swimming area. Both Christie and Valens Conservation Areas readily service the communities of the Golden Horseshoe from Toronto to St. Catharines as well as Guelph, Cambridge and Brantford and are among the most popular recreation sites in southern Ontario.

The watercourse above Valens dam drains an area of approximately 30 km^2. Land use upstream includes:

Pasture	402.1 ha
Small grains	390.2 ha
Row crops	25.7 ha
Woodlots	346.4 ha
Wetland	70.3 ha
Urban	0.0 ha

Livestock operations, including dairy, beef, swine and poultry, and cash cropping predominate(MacLaren Plansearch, 1990).

FIGURE 1.3.4
Valens Reservoir and Swimming Area



WATER QUALITY MONITORING

2.1 WATER QUALITY HISTORY

2.1.1 Valens Reservoir Beach

Water quality monitoring by the Regional Health Unit began shortly after the construction of the Valens dam and reservoir. Although bacterial concentrations usually met provincial guidelines, the swimming area began to experience a severe "swimmers itch" problem caused by the cercariae of a trematode parasitic on waterfowl. Bacterial contamination became a problem during rain events. With no other solution available, in 1972 the HRCA installed a vinyl coated, nylon curtain to separate the swimming area from the rest of the reservoir. Gaseous chlorine is added to water circulated through a pump room. Over 2 tonnes of chlorine are used annually and the curtain has had to be replaced once in the intervening years. High bacterial concentrations associated with rain events continue to be monitored in the reservoir.

2.1.2 Christie Reservoir Beach

The swimming area at Christie reservoir opened to the public in 1972. Almost immediately, monitoring by the Regional Health Unit indicated that bacterial concentrations did not meet guidelines. While concentrations associated with rain events were always unacceptably high, concentrations during dry periods often exceeded the guidelines. In order to avoid beach closures during the summer, in 1974 the HRCA installed another vinyl coated, nylon curtain and chlorination system. As much as 6 tonnes of chlorine are used annually and the cost of replacing the curtain is considerable. Eventually, a monofilament overhead bird screen was installed at the Christie swimming area to discourage gulls, ducks and geese from loafing in the area.

In recent years the HRCA became concerned over the rising costs of maintaining the two swimming areas and began to explore alternate solutions to the water quality problems in the reservoirs. As efforts to rehabilitate the Spencer Creek watershed, Cootes Paradise and the Hamilton Harbour increased, the HRCA decided that better permanent solutions must be available.

2.2 OBJECTIVES

The objective of the 1993 HRCA water quality monitoring program was to identify the sources and types of bacterial pollutants that affect the Spencer Creek watercourse and the Christie and Valens swimming areas. To achieve this objective an extensive water sampling network was established. The water quality analyses consisted of:

(i) bacterial analyses
(ii) nutrient, chemical and physical analyses

2.3 PARAMETERS ANALYZED

2.3.1 Bacterial Parameters

Bacteria are micro-organisms. Certain bacterial types can be used to decide the relative suitability of water for recreational use. Indicator bacteria, some of which may be pathogenic, are commonly found in the presence of disease-causing bacteria originating in animal and human feces. These bacteria can be measured to assess their concentration. The relative concentrations are then used to suggest the safety of water for recreational use. Faecal coliform (FC), *Escherichia coli* (EC), Faecal Streptococci (FS) and *Pseudomonas aeruginosa* (PA) are all examples of indicator organisms. Ministry of the Environment and Energy (MOEE) samples were analyzed for FC, EC, FS and PA concentrations.

The following is a description of each indicator organism studied throughout the program:

2.3.1.1 Faecal Coliform

Faecal coliform (FC) are the most commonly analyzed indicator of bacterial pollution. FC are present in the intestines of all warm blooded animals. Currently, a reliable means of distinguishing between human and animal sources has not been developed. Faecal coliform can enter a watershed through agricultural runoff or faulty septic systems, as well as from natural sources. Faecal coliform alone are not a health risk in the aquatic environment, although high concentrations may cause eye and skin irritations or intestinal upsets. However, they are often associated with pathogenic bacteria, which may pose a risk. The presence of elevated numbers of FC in the aquatic environment is indicative of faecal contamination and the possible presence of enteric pathogens (Dept. of National Health and Welfare, 1983). The faecal coliform group is composed of several genera, including *Escherichia*.

2.3.1.2 *Escherichia coli*

Escherichia coli (EC) is the most common form of faecal coliform bacteria, comprising as much as 97 percent of the coliform organisms in feces (Dept. of National Health and Welfare, 1983). One advantage of using *E. coli* as an indicator organism is that it does not grow naturally in the environment. As such, its presence serves as a useful indicator of recent faecal contamination. Since it is a component of the faecal coliform population, *E. coli* concentrations will be lower than that of faecal coliform. *E. coli* are occasionally pathogenic to humans and may cause intestinal problems. The MOEE recreational guideline for *E. coli* is 100 EC/100 ml of water (MOEE, 1984).

2.3.1.3 Faecal Streptococci

Faecal streptococci (FS) do not belong to the coliform group of bacteria. In the past FS were used in ratio to faecal coliform as an indicator of the potential faecal source (i.e. animal versus human). Recent research seems to suggest that such ratios are neither reliable nor valid. There is no MOEE guideline for this bacteria.

2.3.1.4 Pseudomonas aeruginosa

Pseudomonas aeruginosa (PA) is the only direct indicator of human feces. PA may be pathogenic and can cause various infections. There is currently no MOEE guideline for Pseudomonas aeruginosa concentrations in recreational water (MOEE, 1984).

2.3.2 Nutrient, Chemical and Physical Parameters

Human and animal faecal contamination, soil erosion and fertilizer runoff may result in high levels of nutrients such as phosphates and nitrates within the watercourse. Nutrient loading may ultimately result in excessive growth of aquatic vegetation and subsequent eutrophication. The presence of nutrients may be used in conjunction with bacteria levels to identify point and non-point sources of pollution.

The following nutrient, chemical and physical parameters were analyzed by the MOEE throughout the study.

2.3.2.1 Nutrient/Chemical

i) pH

The symbol pH is used to designate the logarithm of the reciprocal of the hydrogen-ion concentration (MOEE, 1989). The pH is an index of the acidity or alkalinity of a solution. A pH of 7 corresponds to neutral. A reading of less than 7 is acidic while a reading above 7 is alkaline. Bedrock composition and rainfall tend to have the greatest impact on the pH of surface waters. Natural systems should have a pH in the 6.5 to 8.5 range (McNeely et al., 1979).

ii) Chloride

Chloride is a major inorganic anion that occurs naturally in freshwater. Sources include the weathering and leaching of sedimentary rocks and soils, as well as domestic sewage, municipal storm drainage and road salting (MOEE, 1989). The seasonal trend is for chloride levels to increase over the summer months. Though chlorides present no direct health hazard, it is recommended that concentrations not exceed 250 mg/l (McNeely et al., 1979).

iii) Total Phosphorus

Total phosphorus measures all forms of phosphorus, in both soluble and inorganic forms. It is a non-metallic element and can occur naturally in many organic and inorganic forms. It can be present in water as dissolved or particulate species. The Ministry of the Environment and Energy has established a guideline of 0.03 mg/l to eliminate excessive aquatic plant growth and the resultant eutrophication (MOEE, 1984).

iv) Dissolved Reactive Phosphorus

Dissolved reactive phosphorus or reactive phosphate is the soluble portion of the total phosphorus measurement. Dissolved reactive phosphorus is readily available for plant uptake and will cause eutrophication when present in excessive amounts (MOEE, 1989). There is no recommended guideline for phosphate levels.

v) Total Kjeldahl Nitrogen

Total Kjeldahl nitrogen (TKN) is a measure of ammonia and organic nitrogen that enters a watercourse due to soil erosion or fertilizer runoff (McNeely et al., 1979). Though there is no recommended guideline for TKN, watercourses not influenced by excessive organic inputs generally have TKN levels ranging from 0.1 mg/l to 0.5 mg/l (McNeely et al., 1979).

vi) Ammonia Nitrogen

Ammonia is important because of its relationship with ammonium. Total ammonia nitrogen is the measurement of dissociated ammonium and ammonia, the most reduced inorganic form of nitrogen in water. The concentration of total ammonia is dependent upon the pH and temperature of the watercourse.

vii) Nitrate Nitrogen

Nitrate is the principal and most stable form of combined nitrogen found in natural waters. Sources of nitrate include fertilizer runoff, feces and decaying plant and animal debris. The nitrate nitrogen concentration is rarely greater than 0.5 mg/l in unpolluted waters (MOEE, 1989). Though there is no MOEE guideline for recreational water, the MOEE guideline for drinking water is 10 mg/l for nitrate plus nitrite (McNeely et al., 1979).

viii) Nitrite Nitrogen

Nitrite is an intermediate oxidation product of ammonia and an intermediate form in the denitrification process from nitrate to nitrogen gas. It is very unstable (MOEE, 1989). The presence of nitrite concentrations above 0.001 mg/l in surface waters suggests active biological processes influenced by organic pollution (McNeely et al., 1979). There is no MOEE guideline for nitrites; however, McNeely (1979) recommends that nitrite concentrations in drinking water should not exceed 1 mg/l. A limit of 10 mg/l nitrite plus nitrate is recommended for drinking water (McNeely et al., 1979).

ix) Dissolved Organic Carbon

Dissolved organic carbon (DOC), along with particulate organic carbon, makes up the total organic carbon component of water. It is the product of the aquatic plants and animals within the river ecosystem, along with runoff from agricultural lands (MOEE, 1989). Total organic carbon bears a direct relationship with both the biochemical and chemical oxygen demands and varies with the composition of the organic matter present. The ratio of DOC to particulate organic carbon in water is usually 10 to 1, with the majority being composed of humic substances and partly degraded plant and animal materials. The total organic carbon content in natural waters may vary from 1 to 30 mg/l (McNeely et al., 1979). There is no MOEE guideline.

2.3.2.2 Physical

i) Conductivity

Conductivity is a numerical expression of the water's ability to conduct an electric current. As such, it is a measure of the dissolved ions in the water. There is no MOEE guideline for conductivity.

ii) Particulate Residue

The particulate residue is a measure of the total suspended solids in the water column. There is no MOEE guideline for particulate residue.

iii) Turbidity

Turbidity is the measure of the suspended solids and colloidal matter that reduces water clarity and light penetration (MOEE, 1989). Suspended matter in water absorbs, reflects and scatters light. While there is no MOEE guideline for turbidity, readings in excess of 1.0 Jackson Turbidity Units (JTU) can impair light penetration sufficiently to deter aquatic plant growth. Recommendations for water with direct recreational contact range from 5 to 50 JTU (McNeely et al., 1979).

2.4 SAMPLING METHODOLOGY

2.4.1 Location of Sampling Stations

Thirty sampling stations were established within the study area. Criteria used for the selection of sample stations included:

i) the need for obtaining a complete representation of the watershed.
ii) a knowledge of pollution sources identified during previous studies.
iii) the visual identification of potential pollution sources.
iv) the accessibility of sites.

Figure 2.4.1 shows the location of sampling stations throughout the Spencer Creek watershed.

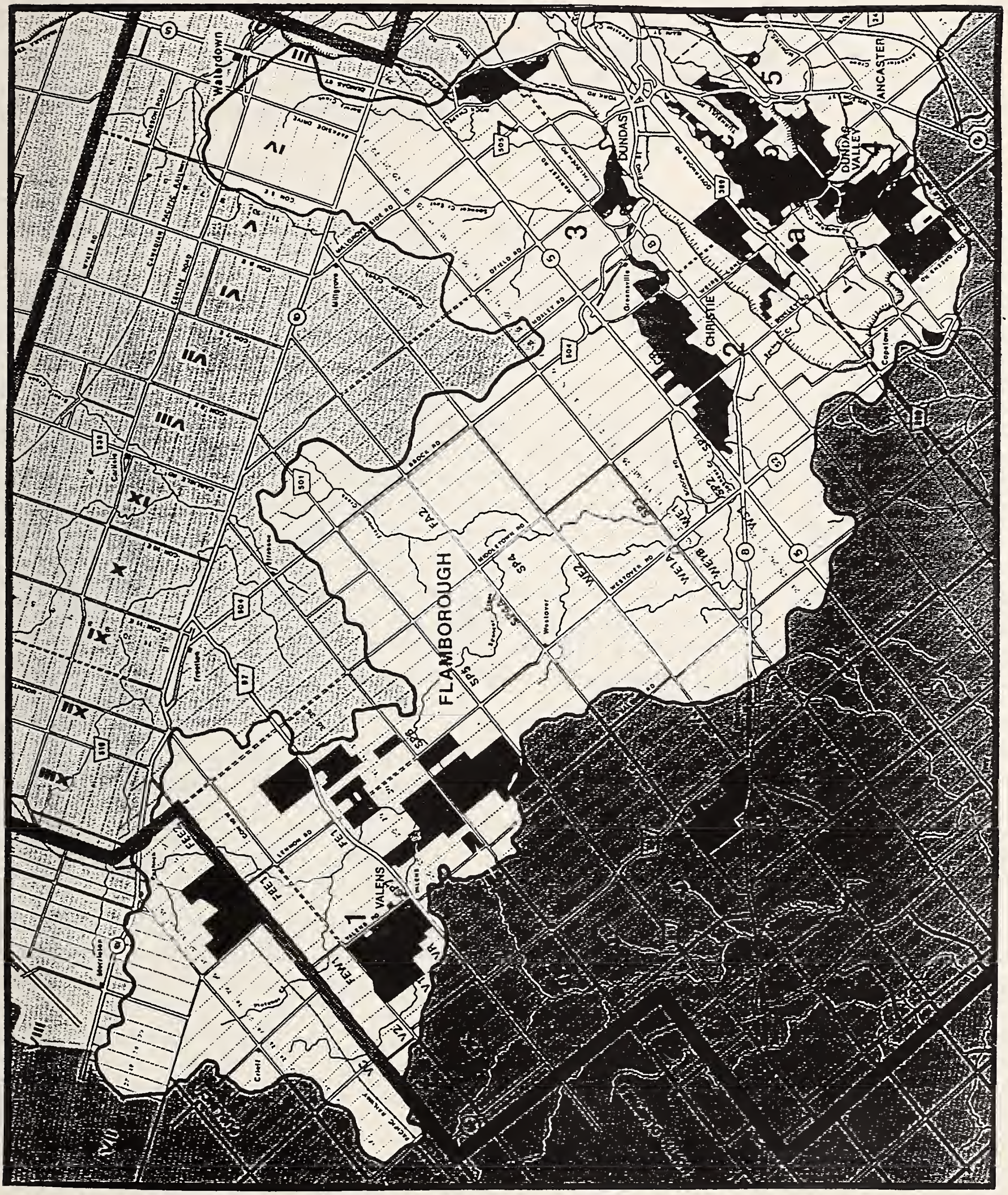
2.4.2 Frequency of Sampling

Most stations were sampled between May 4, 1993 and September 15, 1993 by HRCA staff. As the season progressed some stations were added or deleted to help further define possible pollution sources. Stations were sampled once every two weeks from May 4th until June 16th and then weekly thereafter. The high frequency of sampling was required to determine any short or long term variations in bacterial levels that can result from fluctuations in climate, water levels, agricultural practices or other factors.

2.4.3 Sampling Procedure

Bacterial samples for the Ontario Ministry of the Environment and Energy were collected in 250 ml sterile bottles provided by the MOEE. The sample bottle was placed in a telescoping retriever and immersed in the centre of the stream at roughly half the depth. Nutrient, physical and chemical samples for the MOEE were collected in 500 ml sterile bottles in a similar manner. All samples were immediately put on ice and transported to the MOEE laboratory in Rexdale, Ontario.

FIGURE 2.4.1
Location of Sampling Stations in Spencer Creek Watershed



WATER QUALITY ANALYSIS

3.1 OBJECTIVES

The objective of the 1993 HRCA water quality analysis program was to identify and quantify the sources and types of pollutants that were affecting the Spencer Creek watershed and the Christie and Valens swimming areas.

3.2 DATA ANALYSIS

The maximum, 3rd quartile, median, geometric mean, 1st quartile and minimum values were used to summarize the data in the Spencer Creek watershed. With the uneven distribution of the bacteria in space and over time, the geometric mean provides a representative estimate of bacterial concentration by reducing the distorting effects of extreme values. In addition, the monthly geometric means and/or averages were calculated.

The intensity, distribution and amount of precipitation within a watershed can have a significant effect on water quality. Increased bacterial loading may result from manure runoff, inadequate septic systems and urban runoff. High bacterial levels after a rain event may serve as an indicator of any of these problems. Daily rainfall data was recorded from weather stations at Highway 5 (Station SP1) and at Westover (Station SP5)(Figure 2.4.1). The computerized system recorded rainfall and water levels continuously every 15 minutes. The water level data was used to calculate discharge data at the two station sites in the watershed. The geometric means of wet and dry events were calculated for all stations. This study defines a wet event as one with greater than 2 mm of precipitation 24 hours prior to sampling. A dry event is one where there has been no precipitation in the 48 hour period prior to sampling. Samples collected during intermediate conditions were not used in either wet or dry event analyses.

The maximum, 3rd quartile, median, average, 1st quartile and minimum values were used to summarize the nutrient, physical and chemical data.

3.3 SOURCES OF POLLUTION

There are many potential sources of bacterial pollution and nutrient loading within a watershed. A brief description of these sources is provided below to assist with the interpretation of the results.

3.3.1 Stormwater Runoff

Stormwater runoff from urban and rural residential areas transports bacteria and nutrients into the watercourse.

3.3.2 Livestock Access

Unrestricted livestock access to streams often leads to direct pollution of surface waters. In addition, the trampling of streambanks results in increased erosion and sedimentation, which further degrades water quality.

3.3.3 Manure Storage Facilities

Inadequate livestock manure storage allows runoff to transport bacteria and nutrients to the watercourse.

3.3.4 Manure Management

Spreading manure on saturated or frozen soils, spreading too close to a watercourse or applying excess amounts allows runoff to transport bacteria and nutrients to the watercourse.

3.3.5 Milkhouse Washwater Disposal

Milkhouse wastes can contain excessive amounts of bacteria. In addition, the detergents used for cleaning milking systems contain large concentrations of phosphorus. If not properly disposed, these pollutants can enter the watercourse.

3.3.6 Private Septic Systems

Improperly designed, inadequate or outdated private sewage disposal systems may allow leaching of bacteria and nutrients into the watercourse.

3.3.7 Wildlife

Wildlife such as gulls and geese may cause bacterial pollution problems at beach areas. Wildlife may be a significant source of bacterial pollution in watersheds where most of the land area remains in its natural state.

3.4 RESULTS

The data from the water quality monitoring program are presented in Appendices E and F.

While it is not necessary to discuss the results of the water quality monitoring program in great detail, a few general comments are appropriate. For the portion of the watershed upstream of Christie reservoir the most significant sources of pollution were generated along a tributary known locally as Westover Creek. Stations WE1, WE1B and WE1A, located along this tributary (Figure 2.4.1), regularly had some of the highest readings anywhere in the watershed. The sources became readily apparent. There were a total of 10 significant farm operators situated along the watercourse, including 4 dairy, 2 pig, 1 poultry, 3 livestock and 2 cash crop farms. Landowner interviews revealed that two of the dairy farms were discharging untreated milkhouse washwater directly into the watercourse and all farms with livestock allowed unrestricted access to virtually the entire length of the watercourse. Tile drains delivered bacteria from some barnyard areas. This tributary, located less than 6 kilometres or 24 hours travel time upstream of Christie, was identified as a major pollution source to the reservoir.

Further upstream on the Spencer Creek watercourse, 2 farmsteads were identified as being significant pollution sources. In one case, significant runoff was monitored from a manure storage pad at a pig farm. In the other situation, there was considerable uncontained runoff from the manure pad, as well as unrestricted access by the dairy herd to the watercourse. Results from Station SP4A (Figure 2.4.1) monitored these sources, located approximately 15 kilometres or 30 hours upstream of the reservoir.

Upstream of the Valens reservoir a number of significant pollution sources became apparent. Three farms in particular were identified. In the first case, a livestock operator allows unrestricted access to the watercourse. Further upstream, at a dairy farm located on a small tributary, significant runoff from the manure pile and exercise yard was monitored. The herd also has direct access to the tributary which flows through the heifer yard. Finally, a mixed operation further upstream contributed bacteria from several sources. Pigs, beef cattle and poultry are all raised on the farm. The landowner survey revealed a chronic leak from the liquid manure storage tank, unrestricted cattle access to the watercourse and runoff from the exercise yard. In addition to these readily identifiable sources, there is some concern with a poultry operation upstream of Valens. All of these sources are less than 5 kilometres upstream of the reservoir.

Summaries of the bacterial, nutrient, physical and chemical data for most stations are presented in Appendix E. Data for the other stations is available upon request.

Summaries of the bacterial, nutrient, physical and chemical data for each parameter are presented in Appendix F.

All MOEE bacterial, nutrient, physical and chemical data is available from the HRCA upon request.

CURB MODEL

4.1 OBJECTIVES

The HRCA Clean Up Rural Beaches(CURB) model was designed to predict the faecal coliform bacterial loads from agricultural, rural, urban and natural sources, and the relative impact of these loads on both the Spencer Creek watercourse and the Christie and Valens reservoir beach areas.

The model predicts:

A) The watershed bacteria load delivered to each swimming area from the following agricultural sources:

1. Livestock access to the watercourse.
2. Manure storage and barnyard runoff.
3. Milkhouse wash water

B) The watershed bacteria load delivered to each swimming area from the following other sources:

1. Failed rural septic systems.

4.2 MODEL DEVELOPMENT

A CURB model is a mathematical model designed to predict the total annual faecal coliform and phosphorus loads to rural beaches. The CURB model used by the HRCA was a modification of the PLOP (Pollution from Livestock Practices Predictor) model developed for the Ministry of the Environment by Ecologistics (1988). To date, several Conservation Authorities have produced CURB plans for their own watersheds. Each model has been customized to better reflect local conditions and situations. The HRCA based its CURB model on those of the Halton Region Conservation Authority(Gale, 1992), the Metropolitan Toronto and Region C. A.(Mar, 1991), the Maitland Valley C. A.(Fuller & Foran, 1989) and the St.Clair Region C.A.(Weselan, 1991). Components of the algorithms were altered to more accurately reflect conditions in the Spencer Creek watershed.

While other Conservation Authorities had used subwatersheds as the smallest unit of evaluation, the HRCA pollutant inputs were calculated for individual farm operations. Although both Christie and Valens reservoirs are located on the Spencer Creek watercourse, for modelling purposes pollution inputs to each swimming area were calculated separately.

For modelling purposes the total watershed was divided into two distinct sub-watersheds. That is, the total load delivered to Valens included only those sources upstream of that reservoir, while the total load delivered to Christie swimming area included only those sources upstream of Christie reservoir but downstream of Valens reservoir. Water quality data from Station SP7, located at the outlet of the Valens reservoir (Figure 2.4.1) indicated that the reservoir was acting as a settling pond to such an extent that the quality of the outflow was better than anywhere else in the watershed. Very little, if any pollution entering the watercourse upstream of the Valens reservoir was being transported downstream of the dam. Consideration was also given to modelling the Beverley Swamp portion of the lower watershed as another "reservoir." However, a lack of accurate data and model simplicity precluded this approach.

Field data for the model was collected from ongoing water quality sampling, airphoto analysis and stream assessments. Based on information from the Towns of Flamborough it was estimated that there were some 151 rural landowners with properties next to the Spencer Creek watercourse. In addition, it was estimated that a trailer park located just downstream of the Beverley Swamp represented some 300 units.

A "through the windshield" survey of the watershed identified some 40 landowners who were carrying on some type of agricultural operation. Site specific farm data used to calculate bacterial loads from farm operations was gathered as part of the HRCA study during the summer and fall of 1993. Most of these landowners completed a questionnaire concerning livestock operations, manure and waste management practices, cropping and tillage practices, tile drainage and household waste disposal. Information on actual livestock numbers and types, as well as management practices found on the individual farms was also obtained. Other rural residents completed a questionnaire regarding their private sewage disposal systems. All of this information was used to calculate bacterial loads to the watercourse.

Based on an analysis of the watershed, landowner surveys and interviews, it became apparent that while a CURB model might be comprised of many algorithms or formulae, the HRCA model could be relatively straight forward. All agricultural sources were clearly identified. There were no significant urban areas or sewage treatment plants. Only a very limited number of farms had any tile drainage systems. No over-spreading of manure during the summer was reported and any manure spills were undocumented. Wildlife bacterial sources were thought to be somewhat of a factor; however, they were not included in the CURB model because of the a lack of accurate data on wildlife populations in the watershed.

The CURB model only considers bacterial loads during the months of June, July and August (92 days), the prime swimming season. Dry weather or low flow events, wet weather or high flow events and water quality data was only available for the summer months. Winter agricultural practices, including manure spreading, were not included for modelling purposes.

Based on this information,CURB algorithms (formulas) were developed for the following factors:

a) livestock access
b) manure storage/barnyard runoff
c) milkhouse washwater
d) failed septic systems

Phosphorus loads to the beach were not calculated. Excessive phosphorus in a water body can lead to algae blooms that can hinder visibility and consequently lead to beach closures. The water quality monitoring program indicated that phosphorus concentrations in the watershed were high enough to be a concern, even though the reservoirs at Christie and Valens had not been affected by algae blooms. Unfortunately, the data necessary to model phosphorus loads to the watercourse was not available. It is planned to collect this data during the 1994 sampling season and model the phosphorus load in the watershed.

4.3 POLLUTION SOURCES

4.3.1 Livestock Access Sources

Allowing direct access to a watercourse has traditionally been a convenient means of watering livestock. However, feces and urine produced can be discharged directly into the stream course contributing significantly to bacterial contamination. In addition, livestock access contributes to other watercourse degradation problems including streambank erosion, siltation and loss of aquatic habitat. Wherever possible, all livestock operations were inspected for evidence of direct access to the watercourse.

4.3.2 Manure Storage/Barnyard Runoff Sources

Poor manure handling and storage practices can contribute significant bacterial loads to a watercourse, particularly during a wet event. Convenience and cost considerations often mean that manure stacks are located on bare ground immediately by a stream course. Little or no provision is made for runoff capture or containment, resulting in a high rate of transfer of faecal coliform to the watercourse. During farm surveys, manure stacks and barnyards were measured wherever possible.

4.3.3 Milkhouse Washwater Sources

Improper disposal of milkhouse washwater can seriously impact surface water quality by delivering high bacterial concentrations and increasing phosphorus concentrations. It is estimated that approximately 35 kg of phosphorus is produced by each dairy farm annually (Mar, 1991). If it is being improperly disposed of it can enter the watercourse and result in excess algae and aquatic vegetation growth. High levels of bacteria growing on the milk wastes can seriously degrade surface water quality. During farm surveys, dairy operators were inspected for evidence of improper milkhouse waste disposal.

4.3.4 Failed Septic System Sources

Failed septic systems are those that are delivering bacterial loads to the watercourse via surface "blowouts," subsurface tiles, storm drains or ditches etc. All rural dwellings located within 200 m of a watercourse were included in the model. The bacterial load for all failed septic systems was based on a failure rate estimated to be 30 percent (Alex Campbell, pers. comm.). Based on data supplied by the MOEE, field observations and land owner interviews, a 50 percent transport factor was estimated.

4.4 EQUATIONS

The following are the individual algorithms used to calculate the bacterial load delivered to the watercourse from each source. Each algorithm is presented as a mathematical equation with notes of explanation on the individual components following.

The individual algorithm calculations are available from the HRCA upon request.

4.4.1 Livestock Access Algorithm

This algorithm estimates the total faecal coliform loading to a watercourse from livestock access.

Access Load = conc./defec. x EAU x prob. of defec. x # access events/day x # animals x # days

1. A concentration of 8.9×10^8 FC/defecation was assumed for all livestock (Fuller & Foran, 1989).
2. The EAU's for each animal type are given in Appendix A.(Ecologistics, 1988).
3. The probability of the animal defecating in the watercourse was assumed to be 0.18 (Demal, 1982).
4. The number of access events per day was assumed to be 2.5 (Demal, 1982).
5. The number of animals was based on the landowner survey.
6. The number of days was 92 for the summer season (PLOP model, Ecologistics, 1988).

4.4.2 Manure Storage/Barnyard Runoff Algorithm

This algorithm estimates the total faecal coliform loading to a watercourse from runoff from manure stacks and barnyards that were within 200 m of a watercourse and had no runoff containment.

Stack/Yard Load = conc. x vol. of runoff x delivery

1. A concentration of 7.5×10^9 FC/ha-mm was assumed for stack runoff (MVCA, 1989)

2. The volume of runoff was calculated as follows:

   Runoff = area of pad (ha) x total seasonal precipitation (mm) x .60

   i) The area of the pad was calculated during landowner surveys.

   ii) The precipitation was considered to be 151 mm over the 92 day summer season (HRCA Data, unpublished)

   iii) It was assumed that the volume of runoff was 60 percent of the total annual precipitation (Coote & Hore, 1978)

3. If the stack was within 200 m of the watercourse and the runoff flowed in that direction, 80% was assumed to reach the watercourse (Weselan, 1991).

4.4.3 Milkhouse Washwater Algorithm

This algorithm estimates the total faecal coliform load to a watercourse from dairy operations without proper disposal methods for their milkhouse washwater.

MWW Load = conc. x vol.of washwater/animal/day x no. of animals x % delivery x # days

1. A concentration of 2000 FC per litre of effluent was assumed (Fuller & Foran, 1989).

2. The volume of washwater per animal per day was based on the landowner survey.

3. The number of animals was based on the landowner survey.

4. The percent delivery was assumed to be 50,000 percent (Weselan, 1991)

5. The number of days was 92 for the summer season (PLOP model, Ecologistics, 1988)

4.4.4 Failed Septic System Algorithm

This algorithm estimates the total faecal coliform load to a watercourse from faulty septic systems. Separate calculations were done for the trailer park component.

FSS Load = conc. x vol./person/day x population x failure rate x delivery x # days

1. A concentration of 1.0 x 10^7 FC per litre of effluent was assumed (Fuller & Foran, 1989).

2. A total volume (consumption) of 275 l/person/day was assumed (A. Campbell, pers. comm.).
   A total volume of 200 l/person/day was assumed for trailers.

3. The rural population was estimated to be 1098 persons. The population was determined by counting the number of houses within 200 m of the watercourse x 3.0 persons/house (OMAF data, 1993). Trailers were assumed to contain 2.0 persons.

5. A failure rate of 30 percent was assumed for all septic systems located within 200 m of the watercourse (Weselan,1991; A. Campbell, pers. comm.).

6. Of the failed systems, it was assumed that 50 percent of the volume of effluent was reaching the watercourse (Weselan, 1991).

7. The number of days was 92 for the summer season (PLOP model, Ecologistics, 1988)

4.4.5 Continuous and Event Discharges

Faecal coliform bacterial loads delivered to the beach from upstream sources were divided into two categories: continuous and event (pulse) discharge loads.

Continuous loads were from those sources that contributed bacteria to the beach area daily, whatever the weather conditions. These sources included livestock access, septic systems and milkhouse washwater.

Event or pulse discharges contributed bacteria during a rain events. These sources included runoff from barnyards and manure stacks.

4.4.5.1 Dry Events

Dry or low flow events were defined as those days that had 0.0 mm precipitation within the previous 48 hours. Dry event conditions were estimated using rainfall data and stream discharge data recorded during 1993. Discharge calculations were made only during June, July and August 1990. This 92 day period defines the summer season and is standardized with the PLOP model (Ecologistics, 1988). Discharge stations are shown in Figure 4.4.1. It was determined that 62 days of the 92 days (67%) had no rainfall and therefore represented dry event conditions (HRCA data, unpublished). In natural systems, slower stream velocities that tend to occur during dry event conditions can be conducive to sedimentation of bacteria attached to sediment particles. For the sake of simplicity and owing to a lack of empirical data, the HRCA CURB model did not take such sedimentation into consideration, and thus, likely overestimated dry event bacterial transport (Mar, 1991).

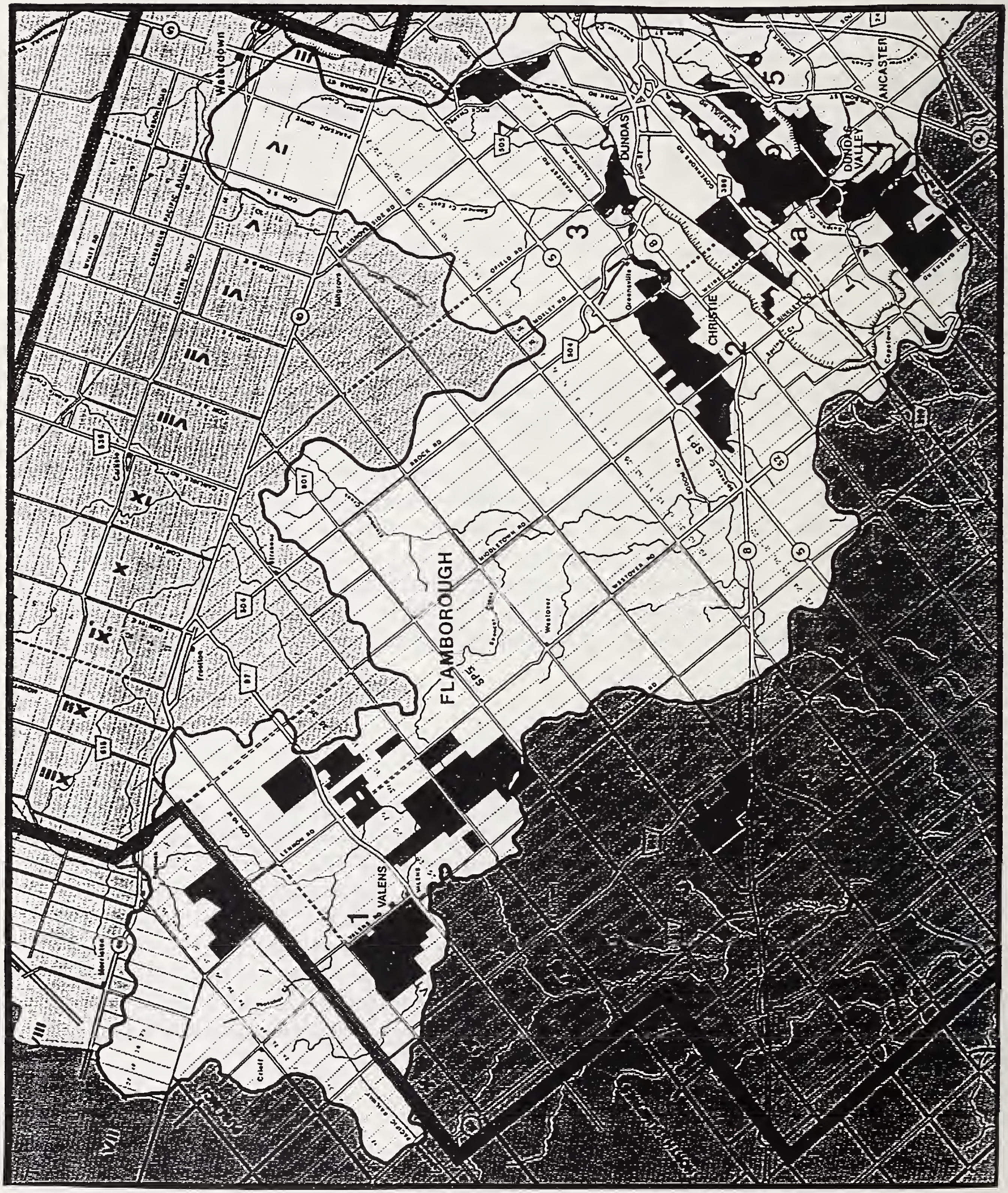
4.4.5.2 Wet Events

Wet or high flow events were defined as those days that had total precipitation of more than 2 mm within the 24 hours prior to the sampling period. Wet event conditions were estimated using rainfall data and stream discharge calculations made during 1993. Calculations were made only during the 92 day summer season. For wet event flows it was determined that 25 days of the 92 days (27%) had precipitation more than 2 mm (HRCA data, unpublished). Again, it should be noted that under high flow/wet weather conditions, stream velocities tend to increase causing the re-suspension of bacteria in the water column. Bacteria deposited during dry event conditions will subsequently be reintroduced into the watercourse for delivery to the beach, along with wet event inputs. The HRCA model did not take such re-suspension into consideration, and thus, likely underestimated wet event bacterial transport (Mar, 1991).

4.4.6 Travel Times

The travel time was defined as the amount of time it took the faecal coliform bacteria to reach the beach from each source. Travel times throughout the watershed were estimated by direct observation. Fluorescein sodium dye was mixed in a 15 l plastic pale and poured into the watercourse at a number of stations and the travel time to the next station was calculated. Whenever possible, travel times for the watershed were calculated for both lowflow/dry weather and high flow/wet weather conditions. Individual section travel times were then summed to estimate total travel times from a source to the beach. Each pollution source was located within each section and the travel time calculated accordingly. For the sake of model simplicity, diffuse bacteria sources such as rural septic systems were modelled as individual inputs at the mid-point of the watershed (Mar, 1991).

FIGURE 4.4.1
Location of Discharge Stations



4.4.7 Decay Rates

Studies carried out by the Ausable Bayfield Conservation Authority (ABCA), the Lake Simcoe Regional Conservation Authority (LSRCA), the Metropolitan Toronto and Region Conservation Authority (MTRCA), the MOEE and others had shown that decay rates of faecal coliform bacteria suspended in the water column vary with temperature, pH and nutrients. In the absence of specific data and because the decay rates are so site specific, it was difficult to assign a decay rate to the Spencer Creek watershed. However, it was decided that the average summer decay rate of 0.35 logs/day obtained from the MTRCA and used in the Halton Region Conservation Authority study was the most appropriate data that could be applied to the Spencer Creek watershed (Mar, 1991; Gale, 1991).

4.4.8 Beach Loads

The following formula was used to calculate faecal coliform loads to each beach:

$$\mathbf{N = antilog(log\ N_0 - (kt))}$$

1. N is the number of bacteria delivered to the beach.

2. N_0 is the initial number of bacteria delivered to the watercourse from a source.

3. k is the log decay rate per day (0.35 logs/day).

4. t is the travel time from the source to the beach.

4.5 PREDICTIONS

4.5.1 Bacterial Loads to the Watercourse

4.5.1.1 Spencer Creek Upstream of Christie Reservoir

Predicted bacterial loads delivered to the Spencer Creek watercourse upstream of Christie reservoir during the summer season are shown in Figure 4.5.1, including the total seasonal load, the load during dry events and the load during wet events. Figure 4.6.1 illustrates the percentage contribution to the watercourse from each source during the season, during dry events and during wet events.

FIGURE 4.5.1

EC BACTERIAL LOAD DELIVERED to the WATERCOURSE UPSTREAM of CHRISTIE RESERVOIR BY SOURCE

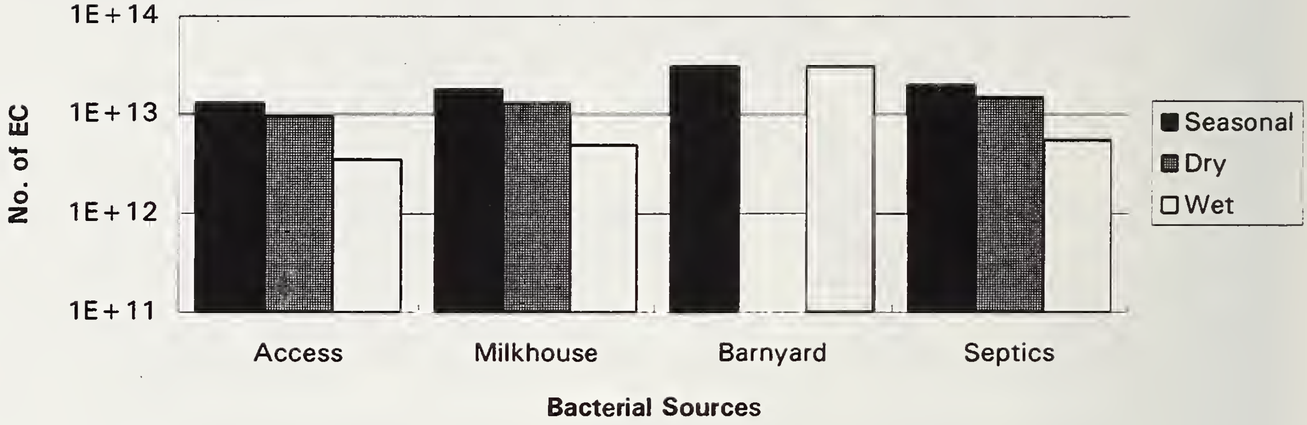
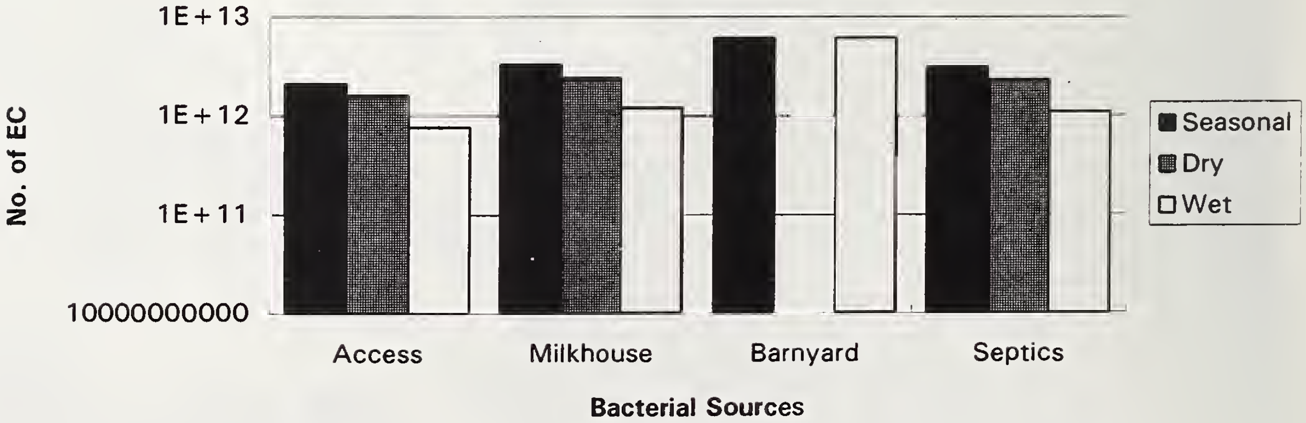


FIGURE 4.5.2

EC BACTERIAL LOAD DELIVERED to the CHRISTIE SWIMMING AREA BY SOURCE



4.5.1.2 Spencer Creek Upstream of Valens Reservoir

Predicted bacterial loads delivered to the Spencer Creek watercourse upstream of Valens reservoir during the summer season are shown in Figure 4.5.3, including the total seasonal load, the load during dry events and the load during wet events. Figure 4.6.2 illustrates the percentage contribution to the watercourse from each source during the season, during dry events and during wet events.

4.5.2 Faecal Coliform Loads to the Swimming Areas

4.5.2.1 Christie Reservoir Swimming Area

Predicted bacterial loads delivered to the Christie reservoir swimming area during the summer season are shown in Figure 4.5.2, including the total seasonal load, the load during dry events and the load during wet events. Figure 4.6.3 illustrates the percentage contribution to the swimming area from each source during the season, during dry events and during wet events.

4.5.2.2 Valens Reservoir Swimming Area

Predicted bacterial loads delivered to the Valens swimming area during the summer season are shown in Figure 4.5.4, including the total seasonal load, the load during dry events and the load during wet events. Figure 4.6.4 illustrates the percentage contribution to the reservoir from each source during the season, during dry events and during wet events.

FIGURE 4.5.3

EC BACTERIAL LOAD DELIVERED to the WATERCOURSE UPSTREAM of VALENS RESERVOIR BY SOURCE

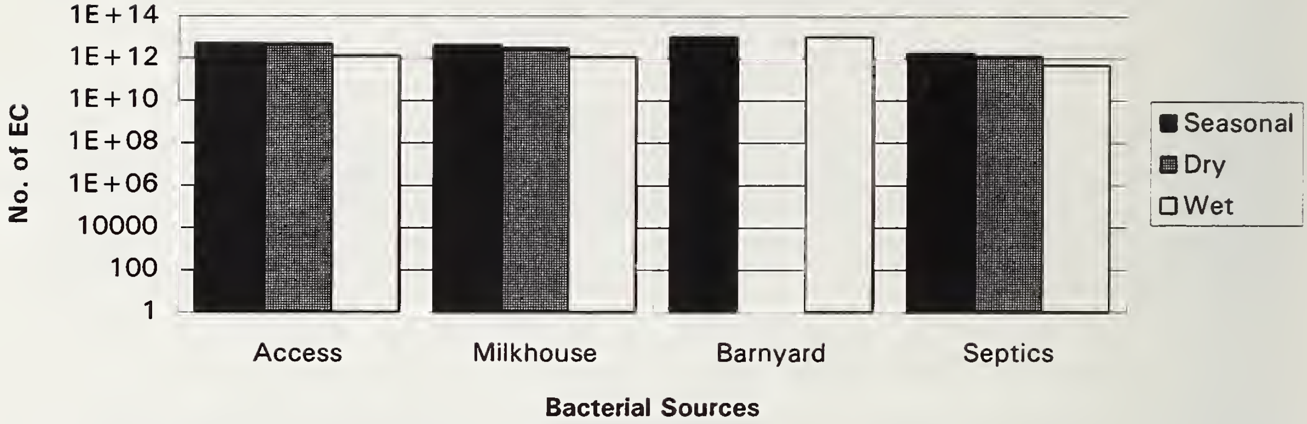
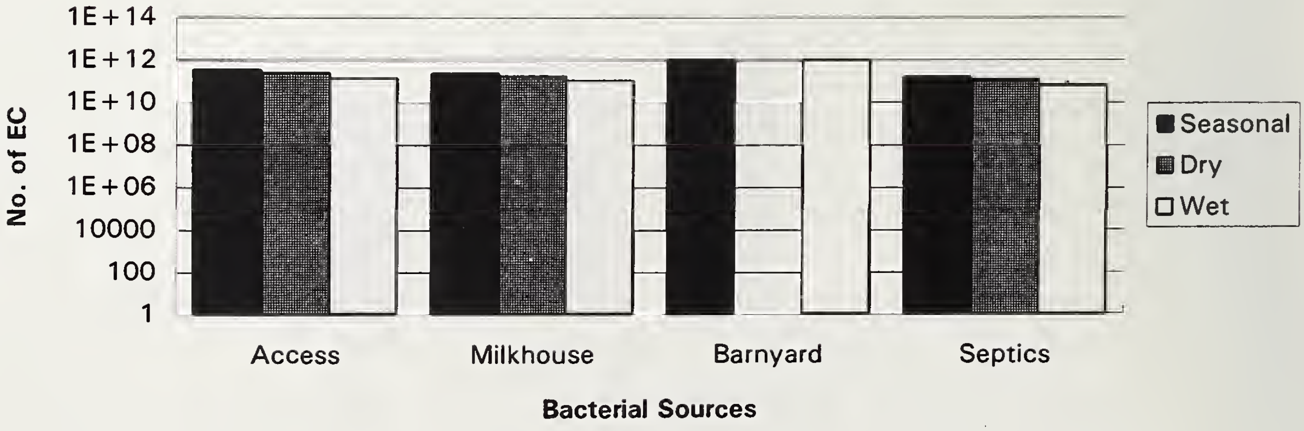


FIGURE 4.5.4

EC BACTERIAL LOAD DELIVERED to the VALENS SWIMMING AREA BY SOURCE



4.6 RELATIVE IMPACTS

4.6.1 Bacterial Loads to the Watercourse

4.6.1.1 Spencer Creek Upstream of Christie Reservoir

Figure 4.6.1 illustrates the percentage contribution to the watercourse from each source during the season, during dry events and during wet events upstream of Christie reservoir. Runoff from barnyards and manure stacks was predicted to account for the largest percentage of the seasonal bacterial load delivered to the watercourse. Approximately 38 percent of the seasonal load and 69 percent of the wet event load originated from this source. Failed septic systems accounted for approximately 24 percent of the seasonal load; however, they accounted for some 40 percent of the dry event load but only 12 percent of the wet event load. Milkhouse washwater disposal was responsible for approximately 22 percent of the seasonal load, 35 percent of the dry event load and 11 percent of the wet event load. Finally, livestock access was responsible for 16 percent of seasonal load, 25 percent of the dry load and 8 percent of the wet load.

4.6.1.2 Spencer Creek Upstream of Valens Reservoir

Figure 4.6.2 illustrates the percentage contribution to the watercourse from each source during the season, during dry events and during wet events upstream of Valens. Again, runoff from barnyards and manure stacks was predicted to account for the largest percentage of the seasonal bacterial load delivered to the watercourse. Approximately 49 percent of the seasonal load and 78 percent of the wet event load originated from this source. Livestock access was responsible for 23 percent of seasonal load, 53 percent of the dry load but only 10 percent of the wet load. Milkhouse washwater disposal was responsible for approximately 20 percent of the seasonal load, 33 percent of the dry event load and 8 percent of the wet event load. Finally, failed septic systems accounted for approximately 8 percent of the seasonal load; however, they accounted for some 14 percent of the dry event load but only 4 percent of the wet event load.

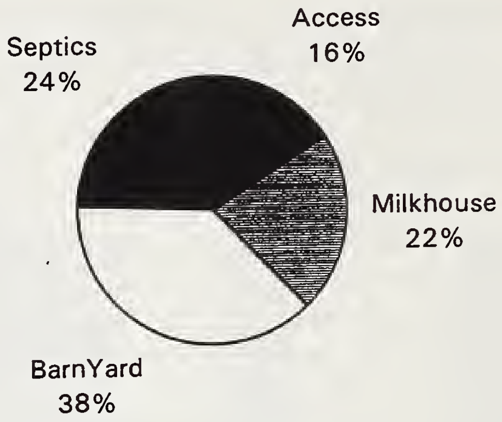
4.6.2 Bacterial Loads to the Swimming Areas

4.6.2.1 Christie Reservoir Swimming Area

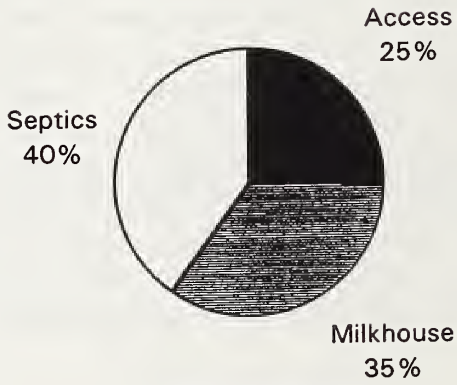
Figure 4.6.3 illustrates the percentage contribution to the Christie swimming from each source during the season, during dry events and during wet events. Similarly to the load delivered to the watercourse, runoff from barnyards and manure stacks was predicted to account for the largest percentage of the seasonal bacterial load delivered to the swimming area. Approximately 42 percent of the seasonal load and 67 percent of the wet event load originated from this source. Milkhouse washwater disposal was responsible for approximately 23 percent of the seasonal load, 38 percent of the dry event load and 13 percent of the wet event load delivered to the swimming area.

FIGURE 4.6.1
EC BACTERIAL LOAD DELIVERED to the WATERCOURSE UPSTREAM of CHRISTIE RESERVOIR by SOURCE

SEASON



DRY EVENTS



WET EVENTS

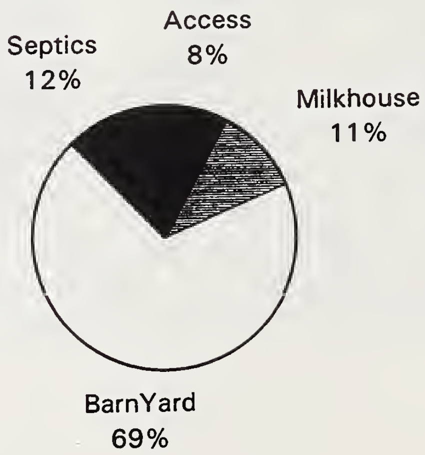
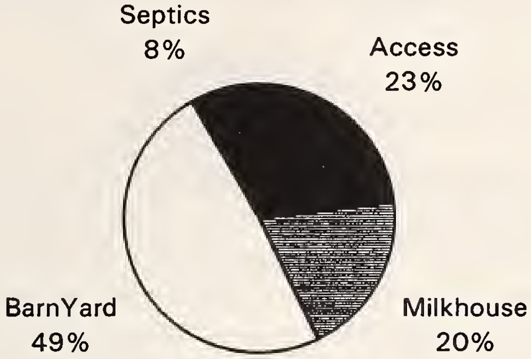
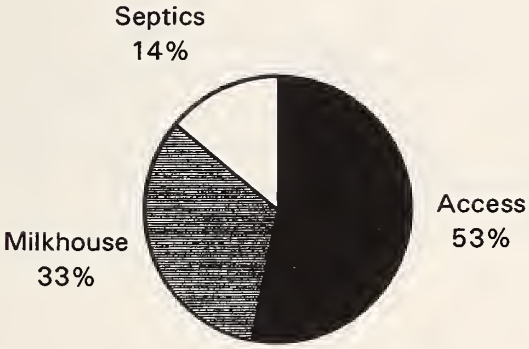


FIGURE 4.6.2
EC BACTERIAL LOAD DELIVERED to the WATERCOURSE UPSTREAM of VALENS RESERVOIR by SOURCE

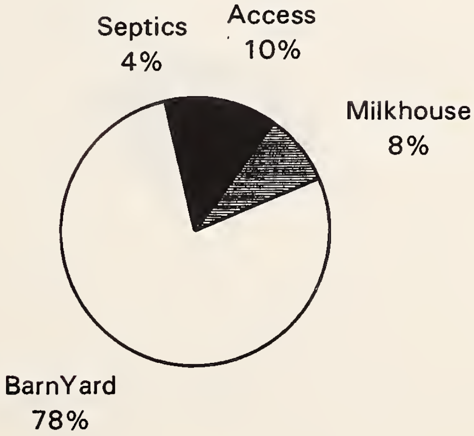
SEASON



DRY EVENTS



WET EVENTS



Failed septic systems accounted for approximately 21 percent of the seasonal load; however, they accounted for some 37 percent of the dry event load but only 12 percent of the wet event load. Finally, livestock access was responsible for 14 percent of seasonal load, 25 percent of the dry load and 8 percent of the wet load estimated to be delivered to Christie reservoir.

4.6.2.2 Valens Reservoir Swimming Area

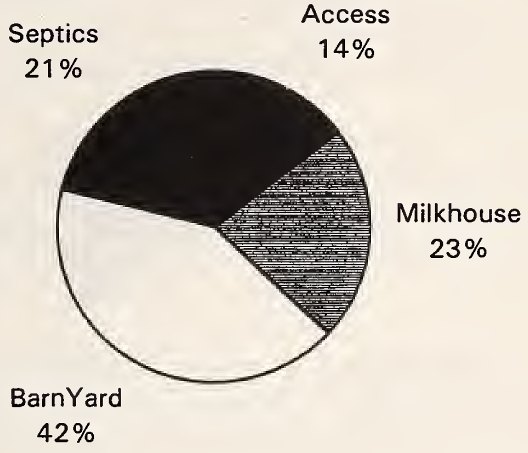
Figure 4.6.4 illustrates the percentage contribution to the reservoir from each source during the season, during dry events and during wet events. Runoff from barnyards and manure stacks was predicted to account for the largest percentage of the seasonal bacterial load delivered to the watercourse. Approximately 57 percent of the seasonal load and 76 percent of the wet event load originated from this source. Livestock access was responsible for 20 percent of seasonal load, 48 percent of the dry load but only 11 percent of the wet load. Milkhouse washwater disposal was responsible for approximately 14 percent of the seasonal load, 32 percent of the dry event load and 8 percent of the wet event load. Finally, failed septic systems accounted for approximately 9 percent of the seasonal load; however, they accounted for some 20 percent of the dry event load but only 5 percent of the wet event load.

Apparently the bacterial load delivered to both the watercourse and to the beach were consistently higher during dry events than during wet events. In the CURB model, continuous flow sources have their 92 day summer season loads divided into 62 dry and 25 wet events. Accordingly, most of the bacteria from the various sources were discharged under dry event conditions. That the largest contributor was runoff from barnyards, exercise yards and manure stacks, which only occur during wet or rain events. This indicates how important it is to eliminate these pollution sources.

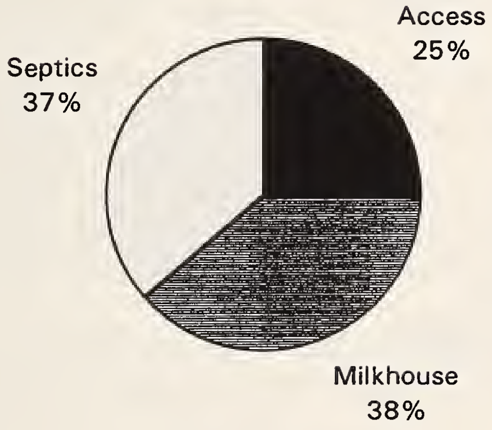
FIGURE 4.6.3

EC BACTERIAL LOAD DELIVERED to the CHRISTIE RESERVOIR by SOURCE

SEASON



DRY EVENTS



WET EVENTS

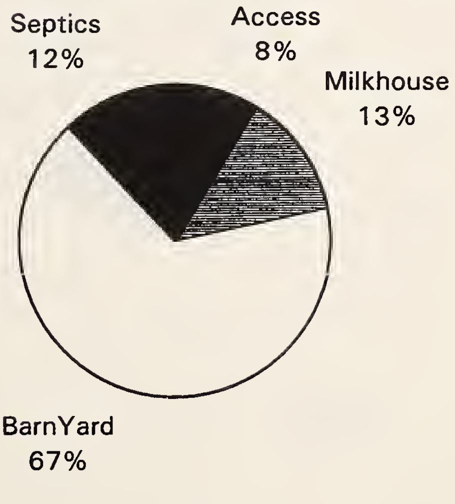
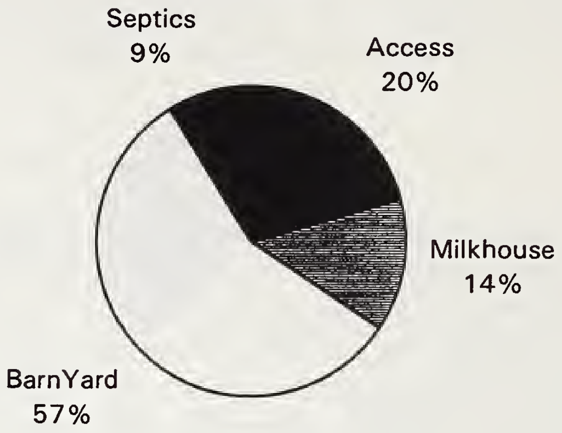


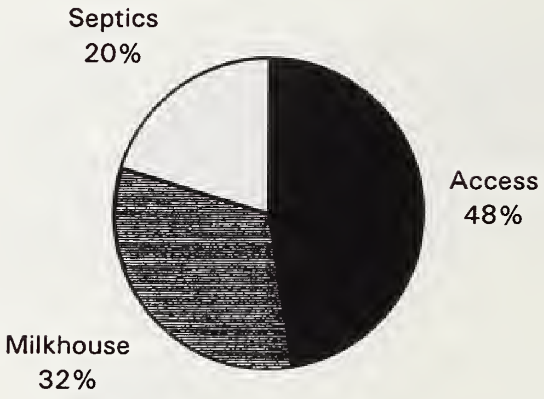
FIGURE 4.6.4

EC BACTERIAL LOAD DELIVERED to the VALENS RESERVOIR by SOURCE

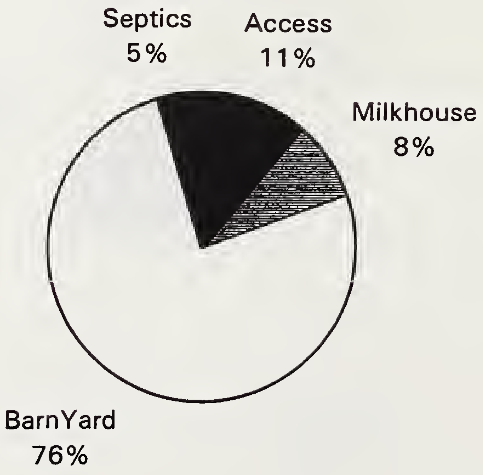
SEASON



DRY EVENTS



WET EVENTS



4.7 LIMITATIONS

The algorithms used to predict the bacterial loads in this report are arithmetic equations. The individual algorithms and thus the model as a whole, were subject to the limitations of the components that make up the algorithms. Some limitations of the algorithms are as follows:

1. There were undoubtedly more pollution sources than were modelled. For example, there could be some impact from manure over-spreading and manure spills. Similarly, there is undoubtedly some impact from wildlife sources. However, a lack of accurate data prevented their inclusion and their relative impact is thought to be relatively insignificant.

2. The volume of runoff from manure stacks and barnyards was based on precipitation being limited to the area of the stack or yard. No consideration was given for runoff from the surrounding areas or buildings impacting the stack or barnyard, increasing the volume and, thus, the load to the watercourse.

3. The failure rate of 30 percent for all septic systems was an estimate. No empirical data was available for the study area. Similarly, the delivery rate of 50 percent was estimated. A survey of all septic systems in the study area would be required to confirm the impact of failed septic systems on the watershed.

4. For the simplicity of the model, some diffuse sources such as septic systems were modelled as point sources at the midpoint of the watercourse section.

5. The model only estimates bacterial loads delivered to the beaches during the summer season. Flow data and water quality data was only available for this season, although contaminants contribute to water quality degradation throughout the year.

6. Discharge data collected at Station V1 used in the verification process was very limited. Only 3 discharge calculations were attempted. No wet event calculations were obtained.

4.8 VERIFICATION

4.8.1 Sensitivity Analysis

The algorithms used to predict the bacterial loads in the HRCA CURB model are arithmetic equations. To demonstrate the relative significance of individual components, the sensitivity of the algorithms to changes in these component values was tested. Sensitivity analyses were conducted for livestock access, stack and barnyard runoff, milkhouse wash water and septic system failures. A single parameter was varied per test and the resultant bacterial load delivered to the watercourse was calculated. This resultant load was then compared to the original load. Certain parameters in the algorithms were considered constants and were not tested, while others were found to vary by orders of magnitude. The ranges of values used to conduct the test was based on values obtained from a literature review and from values obtained from other CURB reports. The results of these tests are available upon request.

In general, the concentration of the bacteria was shown to be the most significant parameter. Variations to the bacterial concentrations resulted in changes of one order of magnitude to livestock access, stack and barnyard runoff and failed septic systems. Variations to other parameters resulted in loads within the same order of magnitude as the base calculations.

4.8.2 Comparisons of Predicted vs Measured Loads at Selected Stations

To test the accuracy of the model predictions, a comparison was undertaken of predicted faecal coliform bacterial loads versus the load measured at a specific station within the Spencer Creek watershed. The measured load was based on stream discharge and water quality data. The station where Spencer Creek crosses Highway 5 (Station SP1), the Westover station where Spencer Creek crosses Concession 7W (Station SP5) and a culvert crossing in the Valens Conservation Area camp grounds upstream of the reservoir (Station V1) were selected for one comparison.

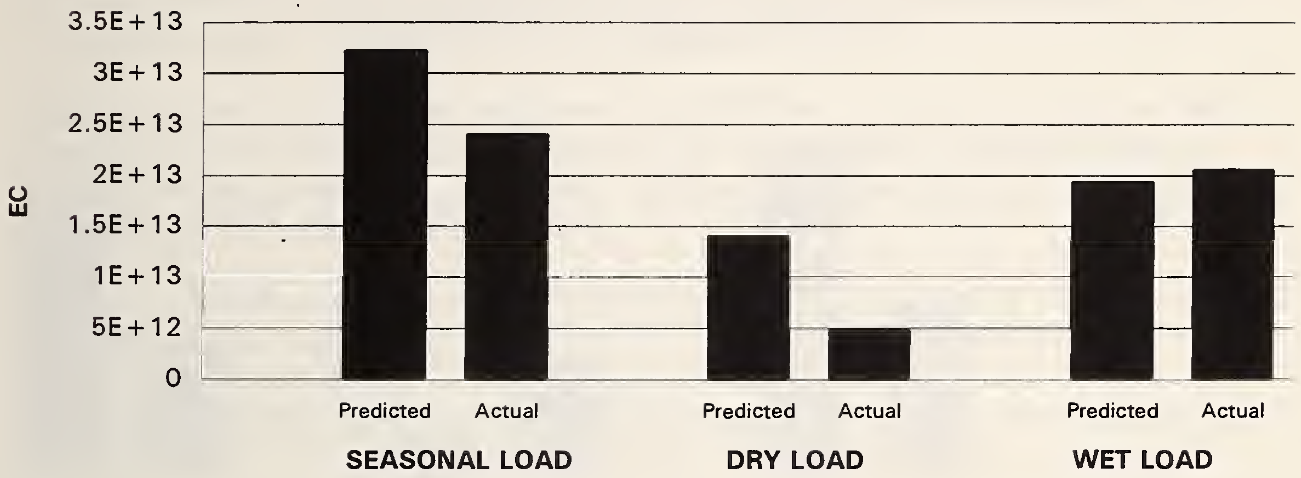
Stream discharge data collected at these stations from June until September, 1993 was used to estimate the total seasonal, the dry event and wet event discharges. Mean densities of faecal coliform bacteria were calculated for each the season, as well as for each event type.

The CURB model predicted that the seasonal bacterial load delivered to Station SP1 was 3.22×10^{13} bacteria. The dry event load was predicted to be 1.40×10^{13} bacteria, while the wet event load was predicted to be 1.94×10^{13} bacteria.

Based on actual discharge calculations and water quality data, the measured seasonal bacterial load delivered to Station SP1 was estimated to be 2.40×10^{13} bacteria or 75 percent of the predicted load. The dry event measured load was estimated to be 4.82×10^{12} bacteria or 35 percent of the predicted load, while the wet event measured load was estimated to be 2.06×10^{13} bacteria or 106 percent of the predicted load. Figure 4.8.1. illustrates the estimated bacterial load at Station SP1 versus the measured load.

FIGURE 4.8.1

COMPARISON OF PREDICTED BACTERIAL LOADS VS ACTUAL BACTERIAL LOADS AT STATION SP1



COMPARISON OF PREDICTED BACTERIAL LOADS VS ACTUAL BACTERIAL LOADS AT STATION SP5

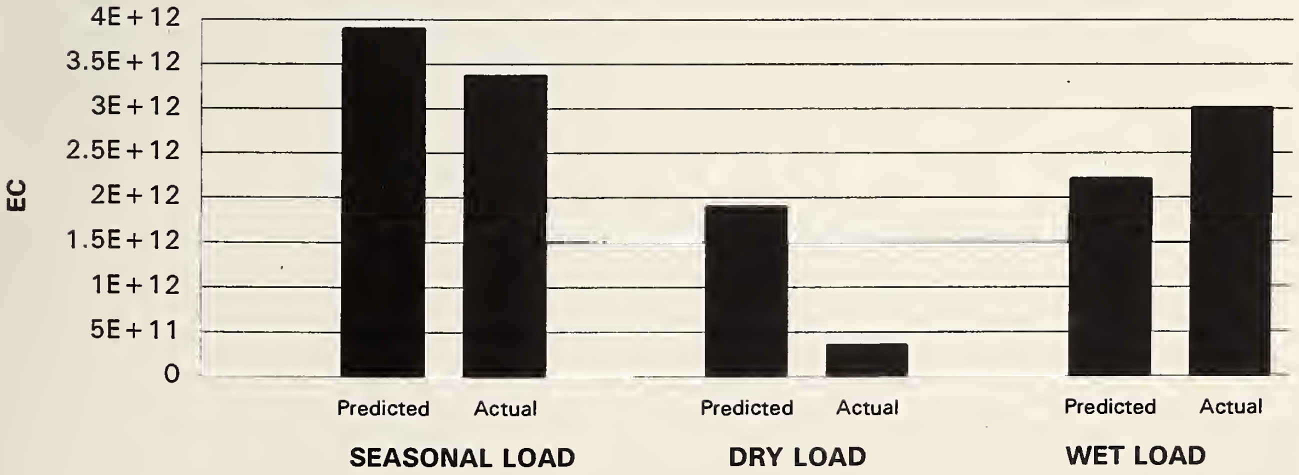
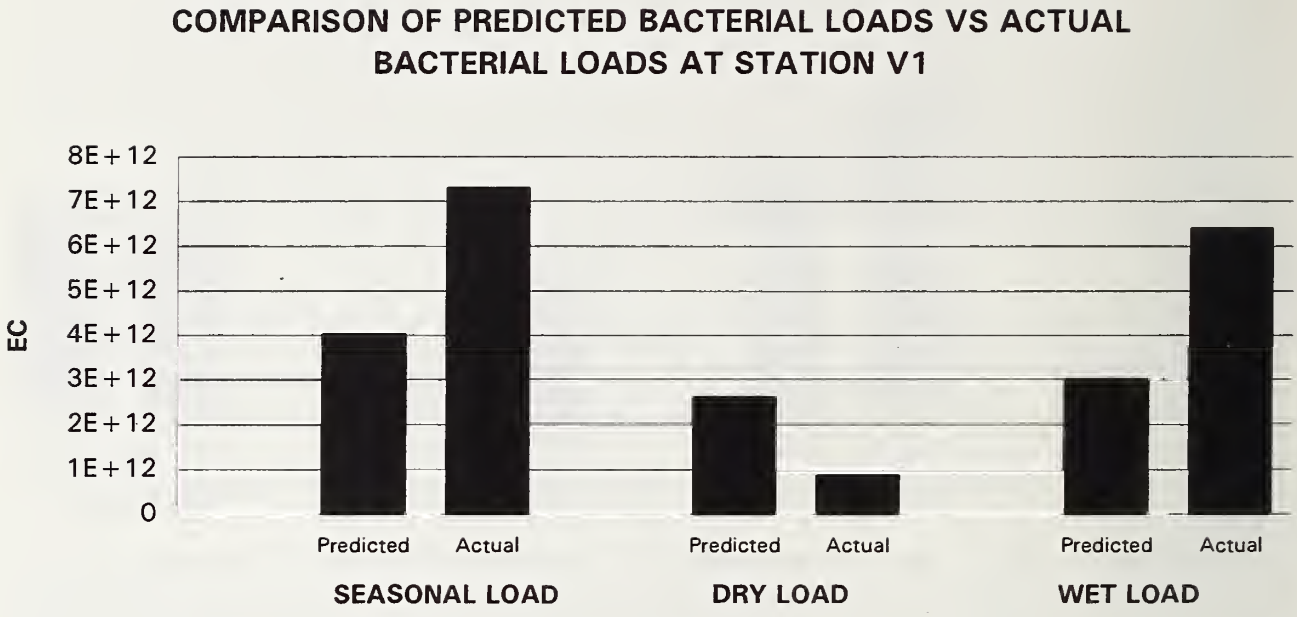


FIGURE 4.8.2


COMPARISON OF PREDICTED BACTERIAL LOADS VS ACTUAL BACTERIAL LOADS AT STATION V1
EC
8E+12
7E+12
6E+12
5E+12
4E+12
3E+12
2E+12
1E+12
0
Predicted
Actual
SEASONAL LOAD
Predicted
Actual
DRY LOAD
Predicted
Actual
WET LOAD

The CURB model predicted that the seasonal load delivered to Station SP5 was 3.90 x 10^{12} bacteria. The dry event load was predicted to be 1.89 x 10^{12} bacteria, while the wet event load was predicted to be 2.21 x 10^{12} bacteria. Figure 4.8.1. illustrates the estimated bacterial load at Station SP5 versus the measured load.

Based on discharge calculations and actual water quality data, the measured seasonal bacterial load delivered to Station SP1 was estimated to be 3.37 x 10^{12} bacteria or 86 percent of the predicted load. The dry event measured load was estimated to be 3.56 x 10^{11} bacteria or 19 percent of the predicted load, while the wet event measured load was estimated to be 3.01 x 10^{12} bacteria or 136 percent of the predicted load.

Finally. the model predicted that the seasonal load delivered to Station V1 was 4.02 x 10^{12} bacteria. The dry event load was predicted to be 2.60 x 10^{12} bacteria, while the wet event load was predicted to be 3.00 x 10^{12} bacteria. Figure 4.8.2. illustrates the estimated bacterial load at Station V1 versus the measured load.

Based on discharge calculations and actual water quality data, the measured seasonal bacterial load delivered to Station V1 was estimated to be 7.3 x 10^{12} bacteria or 182 percent of the predicted load. The dry event measured load was estimated to be 8.80 x 10^{11} bacteria or 34 percent of the predicted load, while the wet event measured load was estimated to be 6.40 x 10^{12} bacteria or 213 percent of the predicted load.

When the relative complexity of predictive modelling of bacterial loads to the watershed is considered, including the number and variability of sources, the size and variability of the watershed and the physical, chemical and biological processes that could affect bacterial populations, the predicted loads appeared reasonable when compared to the measured loads.

As was noted in Section 4.4.6.1 and 4.4.6.2, the CURB model did not consider sedimentation of faecal coliform bacteria during dry event conditions and the re-suspension of some of those bacteria during wet event conditions. Because of this limitation, it was felt that the dry event predictions might overestimate bacterial loads delivered to both beaches while wet event predictions might underestimate actual loads delivered. A comparison of the predicted dry event and predicted wet event loads to the measured dry event and measured wet event loads, respectively, seemed to confirm this theory.

REMEDIATION

5.1 CHRISTIE RESERVOIR

5.1.1 Remediation Costs

Total remedial costs for the Christie reservoir portion of the Spencer Creek watershed were estimated to be approximately $150,000.00 for some 24 projects. Eligible funding for these projects would be $90,000.00 and would result in a bacteria reduction of as much as 90 percent.

5.1.2 Cost Effectiveness

Milkhouse washwater treatment systems were found to be the most cost effective remedial measure with a total cost $15,000.00 and a reduction of 2.2 $\times 10^8$ EC per dollar. Three milkhouse treatment systems would be required. These projects were identified through the landowner contact surveys.

Runoff containment from barnyards and manure stacks was the second most cost effective remedial measure. Five projects with a total estimated cost of $40,000.00 were identified. The cost effectiveness was estimated to be 1.5 $\times 10^8$ EC per dollar.

Upgrading private septic systems was found to be the next most cost effective remedial measure. Five projects costing some $25,000.00 and with a cost effectiveness of some 1.5 $\times 10^8$ EC per dollar were identified.

Finally, livestock access restriction proved to be the least cost effective remedial measure. Some nine projects costing approximately $70,000.00 were identified. The cost effectiveness was 3.0 $\times 10^7$ EC per dollar. The individual costs of some projects was upwards of $20,000.00 and included fencing, crossings and alternate watering facilities.

5.2 VALENS RESERVOIR

5.2.1 Remediation Costs

Total remedial costs for the Valens reservoir portion of the Spencer Creek watershed were estimated to be approximately $50,500.00 for some six projects. Eligible funding for these projects would be $31,625.00 and could result in a reduction of approximately 80 percent in the seasonal load.

5.2.2 Cost Effectiveness

Runoff containment from barnyards and manure stacks was the most cost effective remedial measure. Two projects with a total estimated cost of $20,000.00 were identified. The cost effectiveness was estimated to be 5.1 x10^7 EC per dollar. These projects were identified through the landowner contact surveys.

Milkhouse washwater treatment systems were found to be the second most cost effective remedial measure with a total cost $5,000.00 and a reduction of 5.0 x10^7 EC per dollar. One milkhouse treatment system would be required.

Livestock access restriction proved to be the least cost effective remedial measure. Three projects costing approximately $25,500.00 were identified. The cost effectiveness was 1.4 x10^7 EC per dollar. Both projects cost upwards of $20,000.00 and included fencing and alternate watering stations.

5.3 IMPLEMENTATION STRATEGY

In an effort to improve the water quality at the Christie and Valens reservoir swimming beaches, the HRCA CURB plan recommends that all pollution sources within the study area watershed be systematically addressed. Partial treatment may not achieve significant improvements.

Ongoing data collection and water quality monitoring should be used to assess the success of any fencing programs that are implemented. The rate of adoption of the program or alternative practices should be monitored to evaluate the relative success of information, education and incentive programs. Finally the technical, economic, and social factors that influence the acceptance of the fencing program should be monitored.

During the landowner contact program a number of farmers expressed interest in implementing remedial projects. In view of the total number of projects (approximately 30), it is recommended that remediation in the first year of the CURB program start with those landowners who want to submit applications for financial and technical assistance on a "first-come, first-serve" basis.

5.3.1 Barnyard and Manure Stack Runoff Containment

Precipitation on uncovered manure stacks and barnyards generates runoff that is contaminated with animal wastes. Degradation in water quality occurs when this runoff is delivered to a watercourse via surface flow or through tile systems.

Manure stack and barnyard runoff was predicted to be the major contributor to the bacterial load at both Christie and Valens swimming areas. Remedial actions aimed at eliminating runoff from stacks and barnyards were found to be one of the most cost-effective measures. Four watershed farmers have expressed a willingness to cooperate in reducing pollution from this source.

Upstream of the Christie reservoir there are three farmsteads where runoff from manure storage facilities and barnyards contribute significant loads to the watercourse. The implementation strategy for this portion of the watershed recommends eliminating all three of these sources in the first year of the program. It is estimated that eliminating these three sources will reduce the seasonal bacterial load delivered to the Christie reservoir by approximately 40 percent. The cost of these three projects is estimated to be $30,000.00. All three of these farms are considered high priorities for remediation. Two of the three farmers are now awaiting the approval of their applications in order to proceed, while the third has expressed some interest in the program.

Upstream of Valens reservoir there are two operators where uncontained runoff is significantly degrading water quality. It is estimated that eliminating these two sources will reduce the seasonal bacterial load delivered to the Valens swimming area by over 50 percent. The cost of these two projects is estimated to be $20,000.00. These farms are considered the highest priority for remediation. Again, both farmers are aware of the problem and are more than willing to cooperate. Both are awaiting the start of the CURB program to submit applications.

Beyond the actual remediation projects, the implementation strategy should be aimed at local information and education programs. These should be implemented to encourage other livestock farmers to adopt alternate manure storage and barnyard runoff containment practices. In addition, practices that reduce the volume of runoff by diverting clean water should be promoted. Technical information and assistance should be provided to farmers through existing OMAF engineering and extension services.

5.3.2 Milkhouse Washwater Treatment

Many dairy operations have experienced difficulties in disposing of washwater from their barns and milkhouses. In the past, most treatment trench systems have become plugged with milk residue and have failed. Problems arise when water from the first rinse cycle is passed into the system. Milk solids in this wastewater clog up the tank and tiles, sometimes within days, rendering the system useless. Consequently, most treatment trench systems have a poor reputation among dairy farmers. As a result, some operators use surface drains or direct field tile connections to dispose of washwater, and are, therefore, in violation of the Environmental Protection Act and the Water Resources Act.

Inappropriate disposal of milkhouse washwater was predicted to be a major contributor to the bacterial load in the Spencer Creek watershed. Remedial projects aimed at eliminating washwater from directly entering the watercourse were found to be one of the most cost-effective actions. However, as noted above, treatment trench systems do not provide an adequate solution and should not be considered at this time. OMAF personnel currently are not recommending these systems. Some experiments are continuing at the University of Guelph wherein the first rinse cycle is diverted from the treatment trench and fed to the calves. Such programs should be implemented wherever possible. In addition, every effort should be made to quantify the actual amount of washwater and cleaners used, and to reduce the amounts as much as possible.

Upstream of Christie reservoir, the implementation strategy needs to address three dairy operations where milkhouse washwater is being disposed of directly to the watercourse. It is believed that the elimination of these pollution sources would reduce the seasonal bacterial load delivered to Christie reservoir by about 20 percent. The total cost of these projects is estimated to be $15,000.00. Two of the farms located on the downstream portion of Westover Creek are considered very high priorities. However, in view of the less than satisfactory performance of treatment trench systems, a recommended solution for these sources is somewhat unclear. It is recommended that initial implementation strategies should focus on diverting washwater into storage tanks or runoff containment facilities. By combining containment tanks to handle effluent from a number of sources, costs may be reduced. Other treatment systems, such as flocculators, should be investigated wherever possible. As a last resort, treatment trench systems combined with reduced milk effluent should be examined.

For the Valens portion of the watershed, untreated milkhouse washwater was projected the third largest contributor of bacteria to the reservoir. There is one dairy farm where untreated milkhouse effluent may be impacting a tributary leading to Spencer Creek. It is recommended that this pollution source be treated in conjunction with runoff from the manure pad and barnyard area. That is, all effluent from the barn area be diverted to a single holding facility. It is predicted that eliminating this source will reduce the total bacterial load to the reservoir by about 10 percent.

5.3.3 Access Restriction

Livestock access to watercourses contribute to water quality degradation. Sediments are delivered to the watercourse from stream banks left susceptible to erosion from trampling. Bacterial and nutrient contamination occur because of faecal deposition within the channel. Disease-causing organisms associated with faecal material pose a health risk to downstream users. Nutrients associated with faecal material and manure lead to excess plant growth and reduced oxygen levels in the aquatic environment. In the study area watershed, livestock access to the Spencer Creek watershed was predicted to be a major contributor of bacteria to the reservoirs.

Although livestock access restriction was one of the least cost-effective means of reducing bacterial inputs to the Spencer Creek watercourse, these remedial projects will have a major impact on improving surface water quality. Upstream of Christie reservoir, a total of nine projects are anticipated. The cost of fencing most livestock from the watercourse was estimated at approximately $70,000.00. Several of these projects would involve the construction of water crossings and alternate watering systems. Eliminating this source would reduce the bacterial load to Christie reservoir by about 15 percent.

Upstream of Valens reservoir, the implementation strategy for livestock access restriction should be aimed at three farmsteads, two of which are regarded as high priorities. Eliminating these sources would reduce the bacterial load to the reservoir by approximately 20 percent. The total cost is estimated to be approximately $25,500.00, and both projects would involve alternate watering systems. Both operators appear anxious to participate in the program.

Although some farmers in the study area have already expressed interest in the program, a possible impediment could be prevailing public attitudes. Many landowners surveyed did not regard livestock access as a significant pollution source. Because of the large number of projects and substantial cost of, it is recommended that the implementation strategy initially be geared to those operators who are already willing to participate in the program. At the same time, information and education programs will be used to make other landowners aware of how livestock access degrades a watercourse. The success of efforts to implement fencing projects depends on the acceptance of the need to improve water quality and on a recognition of the impact that livestock access can have on the watercourse. The HRCA, OMAF and local farm organizations should serve as lead agencies to deliver technical information and assistance to landowners.

5.3.4 Septic System Failure

Domestic household waste, including human waste and grey water, should be disposed through proper sewage treatment systems. Where community sewage treatment facilities are not available, septic tank systems are commonly used. Septic systems that are inadequately designed, improperly located or poorly constructed may be a serious source of pollution. Disposal of untreated grey water also causes contamination (Fuller & Foran, 1990).

The HRCA CURB model predicts that as much as 20 percent of the total seasonal faecal coliform bacterial load to the Christie reservoir may originate from failed septic systems. Five systems were thought to be suspect, although only one resident indicated an interest in applying to the program for grant assistance. Without actual evidence that individual systems are contributing to the pollution load, the only implementation strategy for most landowners available appears to be to encourage them to maintain and upgrade their systems. No enforcement is available.

The HRCA, together with the MOEE and Region Health Unit, should undertake a general education program to promote public awareness of the problem. The potential health risks and environmental impacts to the watershed caused by inadequate disposal of household sewage should be emphasized, and landowners encouraged to ensure that they have a properly functioning system. Information days, presentations to interested groups, media releases and fact sheets for local distribution should all be employed as part of the process of public education and increased awareness. Dye testing and water sampling should be offered in an effort to identify substandard systems. Technical assistance and system approvals should continue to be provided by the Region Health Unit.

RELATED CURB BENEFITS

The primary objective of the CURB plan is to implement remedial measures for pollution sources in the Spencer Creek watershed that have been contaminating the downstream swimming areas at Christie and Valens reservoirs. Improving water quality in the watershed will have many benefits not directly related to recreation activities at these conservation areas.

6.1 Economic Benefits

There are several economic benefits associated with the CURB program, some direct, others indirect. One of the direct economic benefits would be to the local economy. Contractors, tradespeople, other workers and suppliers will be required to carry out remedial measures, thus injecting capital into the local economy. The province of Ontario, local and regional governments spend considerable time, effort and dollars on the ongoing maintenance of municipal drains. The life of drains would be greatly increased and maintenance reduced with a reduction in nutrient loads, cattle access and the like. Direct costs to the farmer would be reduced with improved water quality. Cleaner water leads to improved herd health and reduced veterinary costs. Improved water quality may result in improved weight gains and improved yields to the farmer. Improved manure management and handling practices may reduce the costs of and the reliance on commercial fertilizers. Encouraging farmers to seek alternate means of manure disposal could yield a direct economic benefit.

Beyond the direct economic benefits noted above, there would be several indirect economic benefits to watershed residents. Restricting livestock access to the watercourse would result in buffer strips regeneration along the watercourse. These in turn would act as cover and travel corridors for wildlife species. Increased recreational opportunities for hunting, fishing, photography or wildlife viewing would then be available. With the conversion of many marginal farms into recreational or rural residential properties, an improvement in water quality would lead to increased property values. Acreage with a watercourse clean enough to support recreational opportunities, in addition to fish and wildlife species, would be more marketable than one that is in a degraded state.

6.2 Aesthetic Benefits

While much of the Spencer Creek watershed appears to be in relatively pristine condition, any remedial actions undertaken to improve water quality would improve watershed aesthetics. The treatment of bacterial runoff sources would reduce associated nutrient loads that, in turn would lead to a decrease in nuisance algal growth. Eliminating livestock access to the watercourse would reduce streambank erosion, stream bed trampling and sediment loading. Overall water quality and, consequently, aesthetics would improve. Regenerated buffer strips would increase the amount of natural cover, providing a more pleasing vista.

Properly functioning private sewage disposal systems would reduce odours to local residents. Any improvement in water quality and aesthetics throughout the watershed would lead to improvement in the downstream quality of the water at both reservoir swimming areas.

6.3 Fisheries Benefits

Another associated benefit of reduced bacterial and nutrient loads to the watercourse would be improved fisheries habitat. During interviews, many long-time watershed residents lamented the decline in the quality and quantity of the fishery. With reduced nutrient input to the watercourse, there would be a reduction in nuisance algal growth, and consequently a reduction in the biochemical oxygen demand (BOD). This would improve dissolved oxygen levels, leading to an enhancement of the aquatic habitat. Eliminating livestock access would reduce sediment loading, stream bed trampling and the destruction of potential spawning areas. Improvements in water quality would lead to an increase in fisheries diversity and quantity, and ultimately, an increase in angling opportunities throughout the watershed. Any improvement in water quality in the study area would benefit downstream aquatic habitat as well, including Cootes Paradise and the Hamilton Harbour, where millions of dollars are being spent to improve water quality and fish and wildlife habitat.

CURB RECOMMENDATIONS

7.1 CURB RECOMMENDATIONS

The following are the recommendations of the Hamilton Region Conservation Authority's Clean Up Rural Beaches plan:

1. That the Hamilton Region Conservation Authority participate in the Clean Up Rural Beaches program in cooperation with the Halton Region Conservation Authority and the Ontario Ministry of the Environment and Energy to improve water quality in the Spencer Creek watershed and at Christie and Valens reservoirs.

2. That the Hamilton Region Conservation Authority serves as the lead agency, together with the Ontario Ministry of the Environment and Energy, the Ontario Ministry of Agriculture and Food, the Regional Health Unit, the Ontario Soil and Crop Improvement Association, local farm organizations, other agencies and watershed residents in the implementation of remedial measures aimed at reducing bacterial inputs to the watercourse.

3. That information and education programs be undertaken to inform watershed residents of the importance of proper agricultural practices and sewage treatment systems on water quality.

4. That environmental protection incentives available under the CURB program be used to assist all watershed landowners in implementing soil and water conservation measures.

5. That farmers be encouraged to adopt more cost effective conservation measures before less cost effective measures are considered.

6. That livestock farmers be encouraged to adopt improved manure management practices.

7. That dairy farmers be encouraged to treat milkhouse washwater more effectively.

8. That livestock farmers be encouraged to restrict all animals from the watercourse.

9. That farmers be encouraged to reduce the amounts of chemical and natural fertilizers being applied to fields.

10. That watershed residents be encouraged to repair or replace inadequate private sewage treatment systems.

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APPENDIX A

Equivalent Animal Units (EAU)

Animal Type	Weight (kg)	EAU FC	EAU Phosph
Beef Cow		1.04	1.04
Slaughter Steer	455	1.00	1.00
Yearling Beef	365	0.71	0.78
Beef Calf	180	0.48	0.53
Dairy Cow		1.62	1.50
Dairy Heifer	318	0.71	0.75
Dairy Calf	136	0.36	0.46
Sow/Boar			0.60
Feeder Pig	22-90		0.40
Sheep	45	0.02	0.17
Turkeys	4.5		0.03
Chicken/Duck	1.8		0.02
Horse	455	0.013	1.20

From PLOP Model, Ecologistics, 1988.

APPENDIX B

Manure Production Per Day By Animal Type

Animal Type		Production (cu m/ day)
Beef or dairy		
6-15 months		0.0170
15-24 months		0.0227
Beef Cows		0.0340
Dairy Cows	-free stall	0.0581
	-tie stall	0.0616
Swine		
Weaners		0.0023
Feeders		0.0071
Sows & Litter		0.1700
Chickens	-broilers	0.0001
Turkeys	-broilers	0.0003
	-breeders & toms	0.0007
Sheep		0.0042
Horses		0.056

Based on Manure Storage Proposal
Field Sheet

APPENDIX C

Average Faecal Coliform Densities in Selected Animal Feces

Animal Type	Faecal Coliforms/gm *	Faecal Coliforms/cu m
Cattle	5.0×10^{5}	5.0×10^{11}
Swine	1.0×10^{7}	1.0×10^{13}
Chickens	9.9×10^{7}	9.9×10^{13}
Sheep	1.6×10^{7}	1.6×10^{13}
Horses	8.7×10^{4}	8.7×10^{10}

* Provided by M. Young, MOEE, Toronto

APPENDIX D

Travel Times from Selected Sampling Stations to Christie Reservoir Swimming Area

Station Number	Low Flow/Dry Event Travel Times in Days	High Flow/Wet Event Travel times in Days
FE1	3.40	2.80
SP7	3.50	2.70
SP6	3.10	2.50
SP5	2.80	2.40
SP4A	2.30	1.90
SP3	2.00	1.70
WE1	1.80	1.50
SP2	1.50	1.20
SP1	1.00	0.80
CB	0.00	0.00

APPENDIX D

Travel Times from Selected Stations to Valens Reservoir Swimming Area

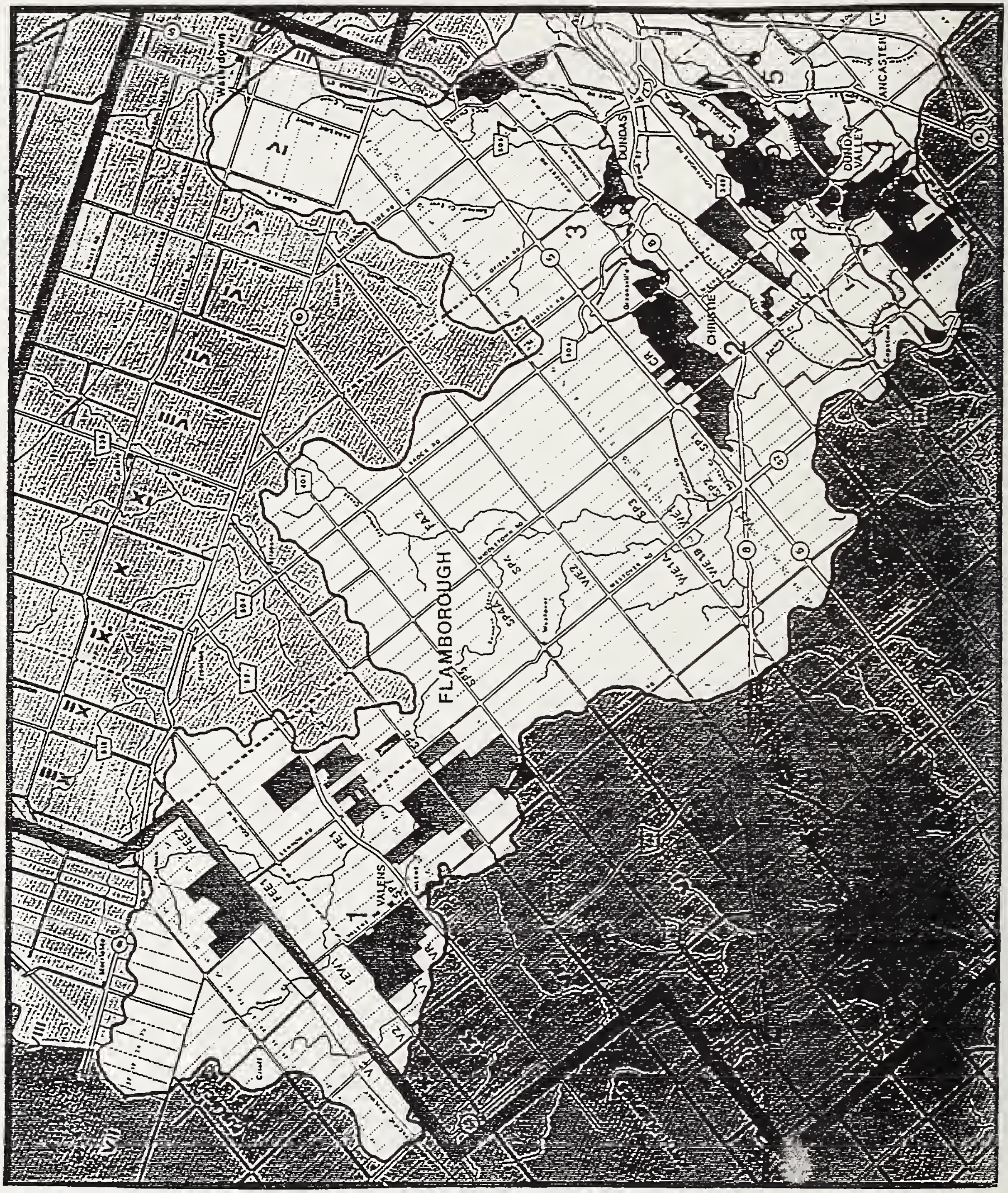
Station Number	Low Flow/Dry Event Travel Times in Days	High Flow/Wet Event Travel times in Days
VC	2.80	2.20
V2	1.80	1.60
V1	1.00	1.00
VB	0.00	0.00

APPENDIX E

Water Quality Data for Selected Sampling Stations in Spencer Creek Watershed

APPENDIX E

Location of Sampling Stations in Spencer Creek Watershed



APPENDIX E

Spencer Creek 1993 - STATION CR Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
2-Jun-93	I	14.0	16	12	4	2	584	8.45	43.4	8.5	2.62	0.028	0.0015	0.920	0.022	1.200	0.0770	7.5
16-Jun-93	I		216	152	12	56	610	8.27	54.8	5.4	3.79	0.038	0.0015	0.880	0.030	0.410	0.0090	7.1
23-Jun-93	D		240	160	20	4	566	8.43	42.9	11.8	6.23	0.044	0.0020	0.960	0.118	0.185	0.0180	8.1
30-Jun-93	D	22.0	230	230	90	2	534	8.37	28.2	17.9	7.95	0.050	0.0015	0.840	0.022	0.250	0.0120	11.0
7-Jul-93	D	29.0	50	50	10	2	570	8.44	33.0	6.1	3.49	0.052	0.0025	0.880	0.070	0.045	0.0090	9.2
21-Jul-93	D	23.5	100	100	40	4	562	8.29	37.9	16.4	12.60	0.058	0.0050	0.800	0.042	0.495	0.0220	7.7
4-Aug-93	D	22.0	40	40	130	2	528	8.40	35.7	10.4	6.74	0.050	0.0025	0.780	0.006	0.010	0.0050	9.8
18-Aug-93	D	26.0	20	20	320	4	519	8.27	40.2	56.9	31.20	0.300	0.0040	2.200	0.022	0.005	0.0030	9.2
1-Sep-93	I	24.5	10	10	30	2	549	8.53	45.3	9.3	7.08	0.004	0.0035	0.280	0.030	0.015	0.0050	8.7
MayGM/Avg																		
JunGM/Avg		14.0	94	66	10	8	587	8.38	47.0	8.6	4.21	0.037	0.0017	0.920	0.057	0.598	0.0347	7.6
JulyGM/Avg		24.8	105	105	33	3	555	8.37	33.0	13.5	8.01	0.053	0.0030	0.840	0.045	0.263	0.0143	9.3
AugGM/Avg		24.0	28	28	204	3	524	8.34	38.0	33.7	18.97	0.175	0.0033	1.490	0.014	0.008	0.0040	9.5
SepGM/Avg		24.5	10	10	30	2	549	8.53	45.3	9.3	7.08	0.004	0.0035	0.280	0.030	0.015	0.0050	8.7
SeasonGM/A		23.0	61	55	33	4	558	8.38	61.1	15.9	13.17	0.065	0.0027	0.904	0.038	0.312	0.0170	8.7
Dry Max		29.0	240	230	320	56	610	8.44	54.8	56.9	31.20	0.300	0.0040	2.200	0.118	0.410	0.0180	11.0
3rd Quart		27.5	230	160	90	4	570	8.43	42.9	17.9	7.95	0.052	0.0025	0.960	0.070	0.250	0.0120	9.2
Dry Median		26.0	216	152	20	4	566	8.37	40.2	11.8	6.23	0.050	0.0020	0.880	0.030	0.185	0.0090	9.2
Dry GM/Avg		25.7	104	89	37	5	560	8.36	39.8	19.6	10.53	0.097	0.0023	1.152	0.052	0.179	0.0102	8.9
1st Quart		24.0	50	50	12	2	534	8.27	33.0	6.1	3.79	0.044	0.0015	0.880	0.022	0.045	0.0090	8.1
Dry Min		22.0	20	20	10	2	519	8.27	28.2	5.4	3.49	0.038	0.0015	0.840	0.022	0.005	0.0030	7.1
Wet Max																		
3rd Quart																		
Wet Median																		
Wet GM/Avg																		
1st Quart																		
Wet Min																		

Spencer Creek 1993 - STATION SP1 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL, CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
4-May-93	W	14.0	32	32	40	2	564	8.30	32.3	6.8	2.73	0.028	0.0015	0.700	0.014	0.585	0.0140	8.4
19-May-93	I	10.5	60	60	24	2	611	8.37	34.4	3.7	2.01	0.020	0.0020	0.680	0.012	0.895	0.0120	7.7
2-Jun-93	I	12.0	428	412	48	2	575	8.33	36.9	4.9	2.34	0.026	0.0020	0.700	0.002	0.750	0.0120	7.3
16-Jun-93	I	17.0	388	380	132	2	581	8.36	33.4	4.9	2.55	0.030	0.0020	0.740	0.038	0.640	0.0230	8.1
23-Jun-93	D	17.0	1900	1900	280	4	570	8.32	33.4	12.7	5.05	0.052	0.0105	0.880	0.050	0.695	0.0260	10.3
30-Jun-93	D	18.5	580	570	230	2	543	8.38	28.0	11.1	6.53	0.044	0.0025	0.800	0.002	0.380	0.0090	10.9
7-Jul-93	D	28.0	590	590	230	2	569	8.57	35.3	10.4	14.80	0.048	0.0035	0.800	0.042	0.395	0.0180	8.7
14-Jul-93	D	23.0	860	830	230	2	572	8.27	35.4	22.0	10.10	0.058	0.0010	0.780	0.034	0.275	0.0080	7.6
21-Jul-93	D	22.0	680	680	920	4	576	8.35	34.6	12.8	9.05	0.038	0.0035	0.620	0.010	0.305	0.0090	7.5
26-Jul-93	W		5200	5200	5100	28	512	8.25	35.2	16.1	11.20	0.056	0.0030	0.840	0.086	0.185	0.0110	8.9
4-Aug-93	D	21.0	500	500	170	2	548	8.36	30.8	12.7	8.10	0.036	0.0020	0.800	0.018	0.130	0.0060	11.7
11-Aug-93	W	22.0	630	620	230	10	551	8.61	34.6	10.0	5.83	0.034	0.0020	0.720	0.032	0.160	0.0070	8.6
18-Aug-93	D	25.0	280	240	20	4	556	8.70	37.2	4.7	4.46		0.0020		0.028	0.335	0.0130	8.0
25-Aug-25	D	23.0	110	90	50	2	513	7.98	41.7	4.5	2.07	0.024	0.0010	0.640	0.034	0.175	0.0110	6.5
1-Sep-93	I	22.0	400	300	230	2	601	8.55	44.7	7.5	4.14	0.036	0.0050	0.640	0.032	0.110	0.0070	5.9
8-Sep-93	I	14.0	760	700	380	2	590	8.35	34.2	10.5	6.37	0.044	0.0165	0.800	0.030	1.280	0.0170	10.8
15-Sep-93	W	19.0	600	580	320	4	574	8.26	33.1	10.3	11.30	0.048	0.0050	0.700	0.024	0.180	0.0080	10.4
MayGM/Avg		12.3	44	44	31	2	588	8.34	33.4	5.3	2.37	0.024	0.0018	0.690	0.013	0.740	0.0130	8.1
JunGM/Avg		16.1	654	642	142	2	567	8.35	32.9	8.4	4.12	0.038	0.0043	0.780	0.023	0.616	0.0175	9.2
JulyGM/Avg		24.3	1157	1147	706	5	557	8.36	35.1	15.3	11.29	0.050	0.0028	0.760	0.043	0.290	0.0115	8.2
AugGM/Avg		22.8	314	286	79	4	542	8.41	36.1	8.0	5.12	0.031	0.0018	0.720	0.028	0.200	0.0093	8.7
SepGM/Avg		18.3	567	496	304	3	588	8.39	37.3	9.4	7.27	0.043	0.0088	0.713	0.029	0.523	0.0107	9.0
SeasonGM/A		19.3	447	424	173	3	565	8.37	35.0	9.7	6.39	0.039	0.0038	0.740	0.029	0.440	0.0124	8.7
Dry Max		28.0	1900	1900	920	4	576	8.70	41.7	22.0	14.80	0.058	0.0105	0.880	0.050	0.695	0.0260	11.7
3rd Quart		23.5	725	718	243	4	571	8.43	35.9	12.7	9.31	0.050	0.0035	0.800	0.036	0.384	0.0143	10.5
Dry Median		22.5	585	580	230	2	563	8.36	35.0	11.9	7.32	0.044	0.0023	0.800	0.031	0.320	0.0100	8.4
Dry GM/Avg		22.2	526	500	164	3	556	8.37	34.6	11.4	7.52	0.043	0.0033	0.760	0.027	0.336	0.0125	8.9
1st Quart		20.4	445	435	140	2	547	8.31	32.8	9.0	4.90	0.037	0.0018	0.710	0.016	0.250	0.0088	7.6
Dry Min		17.0	110	90	20	2	513	7.98	28.0	4.5	2.07	0.024	0.0010	0.620	0.002	0.130	0.0060	6.5
Wet Max		22.0	5200	5200	5100	28	574	8.61	35.2	16.1	11.30	0.056	0.0050	0.840	0.086	0.585	0.0140	10.4
3rd Quart		20.5	1773	1765	1515	15	567	8.38	34.8	11.8	11.23	0.050	0.0035	0.750	0.046	0.285	0.0118	9.3
Wet Median		19.0	615	600	275	7	558	8.28	33.9	10.2	8.52	0.041	0.0025	0.710	0.028	0.183	0.0095	8.8
Wet GM/Avg		18.3	501	495	350	7	550	8.36	33.8	10.8	7.77	0.042	0.0029	0.740	0.039	0.278	0.0100	9.1
1st Quart		16.5	458	443	183	4	541	8.26	32.9	9.2	5.06	0.033	0.0019	0.715	0.022	0.175	0.0078	8.6
Wet Min		14.0	32	32	40	2	512	8.25	32.3	6.8	2.73	0.028	0.0015	0.700	0.014	0.160	0.0070	8.4

APPENDIX E

Spencer Creek 1993 - STATION WS1 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
4-May-93	W		44	44	32	2	591	8.35	32.0	11.1	6.06	0.030	0.0020	0.680	0.010	1.220	0.0160	5.5
19-May-93	I	10.5	276	268	100	2	635	8.35	34.1	9.0	3.56	0.028	0.0025	0.720	0.030	1.550	0.0140	5.9
2-Jun-93	I	13.0	188	188	80	2	626	8.33	41.6	5.6	2.68	0.028	0.0040	0.720	0.012	1.790	0.0180	5.8
16-Jun-93	I		148	144	104	2	649	8.53	44.7	5.9	4.91	0.042	0.0040	0.820	0.018	1.540	0.0340	6.3
23-Jun-93	D	17.0	550	540	360	4	673	8.32	43.0	9.2	5.30	0.058	0.0150	0.920	0.110	2.650	0.0560	6.6
30-Jun-93	D	19.5	730	730	640	2	646	8.22	39.1	9.0	3.68	0.058	0.0155	0.820	0.062	1.770	0.0370	5.3
7-Jul-93	D		210	210	270	2	629	8.35	47.4	5.7	2.85	0.076	0.0195	0.940	0.074	1.140	0.0720	6.8
21-Jul-93	D	21.0	520	520	440	4	709	8.25	53.9	8.0	6.83	0.058	0.0155	0.920	0.024	2.260	0.0750	6.2
4-Aug-93	D	20.5	120	100	60	2	629	8.16	63.5	11.9	9.50	0.100	0.0205	0.980	0.090	0.280	0.0320	6.0
11-Aug-93	W	22.0	680	680	760	2	566	8.42	37.0	6.4	3.43	0.036	0.0020	0.740	0.010	0.270	0.0090	8.1
18-Aug-93	D	24.0	300	300	160	4	572	8.48	37.3	4.1			0.0060		0.028	0.220	0.0130	7.5
1-Sep-93	I	21.0	130	120	60	2	526	8.71	44.4	7.9	5.62	0.146	0.0485	1.620	0.148	0.300	0.0230	11.3
8-Sep-93	I	15.0	640	580	340	2	881	8.15	56.3	29.3	10.30	0.082	0.0320	0.740	0.018	14.600	0.0520	5.5
15-Sep-93	W	19.0	1260	1220	420	4	784	8.19	66.7	16.6	19.00	0.132	0.0065	1.200	0.018	2.140	0.0630	4.8
MayGM/Avg		10.5	110	109	57	2	613	8.35	33.1	10.1	4.81	0.029	0.0023	0.700	0.020	1.385	0.0150	5.7
JunGM/Avg		16.5	325	321	209	2	649	8.35	42.1	7.4	4.14	0.047	0.0096	0.820	0.051	1.938	0.0363	6.0
JulyGM/Avg		21.0	330	330	345	3	669	8.30	50.7	6.9	4.84	0.067	0.0175	0.930	0.049	1.700	0.0735	6.5
AugGM/Avg		22.2	290	273	194	3	589	8.35	45.9	7.5	6.47	0.068	0.0095	0.860	0.043	0.257	0.0180	7.2
SepGM/Avg		18.3	472	440	205	3	730	8.35	55.8	17.9	11.64	0.120	0.0290	1.187	0.061	5.680	0.0460	7.2
SeasonGM/A		18.4	295	285	183	2	651	8.34	45.8	10.0	6.44	0.067	0.0138	0.909	0.047	2.266	0.0367	6.5
Dry Max		24.0	730	730	640	4	709	8.48	63.5	11.9	9.50	0.100	0.0205	0.980	0.110	2.650	0.0750	7.5
3rd Quart		21.0	543	535	420	4	666	8.34	52.3	9.2	6.83	0.076	0.0185	0.940	0.086	2.138	0.0680	6.8
Dry Median		20.5	410	410	315	3	638	8.29	45.2	8.5	5.30	0.058	0.0155	0.920	0.068	1.455	0.0465	6.4
Dry GM/Avg		**20.4**	**341**	**330**	**253**	**3**	**643**	**8.30**	**47.4**	**8.0**	**5.63**	**0.070**	**0.0153**	**0.916**	**0.065**	**1.387**	**0.0475**	**6.4**
1st Quart		19.5	233	233	188	2	629	8.23	40.1	6.3	3.68	0.058	0.0151	0.920	0.037	0.495	0.0333	6.1
Dry Min		17.0	120	100	60	2	572	8.16	37.3	4.1	2.85	0.058	0.0060	0.820	0.024	0.220	0.0130	5.3
Wet Max		22.0	1260	1220	760	4	784	8.42	66.7	16.6	19.00	0.132	0.0065	1.200	0.018	2.140	0.0630	8.1
3rd Quart		21.3	970	950	590	3	688	8.39	51.9	13.9	12.53	0.084	0.0043	0.970	0.014	1.680	0.0395	6.8
Wet Median		20.5	680	680	420	2	591	8.35	37.0	11.1	6.06	0.036	0.0020	0.740	0.010	1.220	0.0160	5.5
Wet GM/Avg		**20.5**	**335**	**332**	**217**	**3**	**647**	**8.32**	**45.2**	**11.4**	**9.50**	**0.066**	**0.0035**	**0.873**	**0.013**	**1.210**	**0.0293**	**6.1**
1st Quart		19.8	362	362	226	3	579	8.27	34.5	8.8	4.75	0.033	0.0043	0.710	0.014	0.745	0.0125	5.2
Wet Min		19.0	44	44	32	2	566	8.19	32.0	6.4	3.43	0.030	0.0020	0.680	0.010	0.270	0.0090	4.8

Spencer Creek 1993 - STATION SP2 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
4-May-93	W	15.0	84	84	44	2	557	8.39	30.8	3.5	1.16	0.020	0.0015	0.660	0.012	0.405	0.0150	9.0
19-May-93	I	10.0	160	156	36	2	604	8.42	33.4	2.6	1.32	0.018	0.0020	0.660	0.010	0.790	0.0120	7.8
2-Jun-93	I	13.0	312	304	52	2	558	8.42	34.5	7.0	1.66	0.024	0.0020	0.660	0.002	0.635	0.0090	7.7
16-Jun-93	I		268	268	44	2	581	8.48	33.0	3.7	1.86	0.026	0.0025	0.700	0.024	0.650	0.0170	8.2
23-Jun-93	D	16.0	910	910	190	4	539	8.36	29.3	9.2	2.98	0.042	0.0060	0.820	0.024	0.395	0.0130	11.1
30-Jun-93	D	19.0	470	460	210	2	531	8.40	26.5	3.9	1.79	0.028	0.0025	0.740	0.002	0.285	0.0060	11.2
7-Jul-93	D		330	320	150	2	585	8.57	34.1	5.6	1.44	0.026	0.0030	0.660	0.002	0.590	0.0140	8.2
14-Jul-93	D	22.0	940	930	160	2	576	8.38	34.7	4.2	1.25	0.020	0.0010	0.600	0.024	0.300	0.0120	7.3
21-Jul-93	D	22.0	940	920	400	4	556	8.63	33.0	8.8	4.20	0.030	0.0020	0.580	0.004	0.210	0.0050	7.5
26-Jul-93	W		3600	3500	7000	4	537	8.18	30.2	15.0	7.07	0.050	0.0025	0.900	0.034	0.585	0.0190	17.9
4-Aug-93	D	20.5	460	460	100	2	529	8.75	29.7	11.6	4.75	0.034	0.0015	0.820	0.010	0.035	0.0050	11.5
11-Aug-93	W	21.0	760	760	600	2	573	8.52	34.6	7.0	2.41	0.028	0.0015	0.740	0.014	0.460	0.0120	8.0
18-Aug-93	D	23.0	420	420	340	4	580	8.54	37.1	6.2	3.22		0.0010		0.018	0.495	0.0130	7.5
25-Aug-25	D	22.0	220	180	210	2	493	8.06	41.8	3.9	1.55	0.022	0.0010	0.620	0.040	0.555	0.0150	6.3
1-Sep-93	I	19.5	380	370	200	2	590	8.57	41.7	5.2	1.05	0.040	0.0040	0.720	0.014	0.270	0.0080	6.2
8-Sep-93	I	15.0	1020	980	280	2	567	8.41	31.1	5.8	2.79	0.036	0.0160	0.660	0.016	0.440	0.0080	11.4
15-Sep-93	W	19.0	620	620	220	4	559	8.38	31.2	3.6	1.99	0.024	0.0015	0.630	0.010	0.175	0.0070	10.7
MayGM/Avg		12.5	116	114	40	2	581	8.41	32.1	3.1	1.24	0.019	0.0018	0.660	0.011	0.598	0.0135	8.4
JunGM/Avg		16.0	435	430	98	2	552	8.42	30.8	6.0	2.07	0.030	0 0033	0.730	0.013	0.491	0.0113	9.6
JulyGM/Avg		22.0	1012	989	509	3	564	8.44	33.0	8.4	3.49	0.032	0.0021	0.685	0.016	0.421	0.0125	10.2
AugGM/Avg		21.6	424	403	256	2	544	8.47	35.8	7.2	2.98	0.028	0.0013	0.727	0.021	0.386	0.0113	8.3
SepGM/Avg		17.8	622	608	231	3	572	8.45	34.7	4.9	1.94	0.033	0.0072	0.670	0.013	0.295	0.0077	9.4
SeasonGM/A		18.4	481	469	189	2	560	8.44	33.3	6.3	2.50	0.029	0.0030	0.698	0.015	0.428	0.0112	9.3
Dry Max		23.0	940	930	400	4	585	8.75	41.8	11.6	4.75	0.042	0.0060	0.820	0.040	0.590	0.0150	11.5
3rd Quart		22.0	918	913	243	4	577	8.59	35.3	8.9	3.47	0.032	0.0026	0.780	0.024	0.510	0.0133	11.1
Dry Median		22.0	465	460	200	2	548	8.47	33.6	5.9	2.39	0.028	0.0018	0.660	0.014	0.348	0.0125	7.9
Dry GM/Avg		**20.6**	**519**	**501**	**202**	**3**	**549**	**8.46**	**33.3**	**6.7**	**2.65**	**0.029**	**0.0023**	**0.691**	**0.016**	**0.358**	**0.0104**	**8.8**
1st Quart		19.8	398	395	158	2	531	8.38	29.6	4.1	1.52	0.024	0.0010	0.610	0.004	0.266	0.0058	7.5
Dry Min		16.0	220	180	100	2	493	8.06	26.5	3.9	1.25	0.020	0.0010	0.580	0.002	0.035	0.0050	6.3
Wet Max		21.0	3600	3500	7000	4	573	8.52	34.6	15.0	7.07	0.050	0.0025	0.900	0.034	0.585	0.0190	17.9
3rd Quart		20.0	1470	1445	2200	4	563	8.42	32.1	9.0	3.58	0.034	0.0018	0.780	0.019	0.491	0.0160	12.5
Wet Median		19.0	690	690	410	3	558	8.39	31.0	5.3	2.20	0.026	0.0015	0.700	0.013	0.433	0.0135	9.9
Wet GM/Avg		**18.3**	**614**	**610**	**449**	**3**	**557**	**8.37**	**31.7**	**7.3**	**3.16**	**0.031**	**0.0018**	**0.733**	**0.018**	**0.406**	**0.0133**	**11.4**
1st Quart		17.0	486	486	176	4	552	8.33	30.7	3.6	1.78	0.023	0.0023	0.653	0.012	0.348	0.0108	8.8
Wet Min		15.0	84	84	44	2	537	8.18	30.2	3.5	1.16	0.020	0.0015	0.630	0.010	0.175	0.0070	8.0

APPENDIX E

Spencer Creek 1993 - STATION WE1 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlor	ResPr	Turbid	Pphor	Pphate	T.K.N.	mmo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
4-May-93	W	14.0	40	40	16	2	668	8.33	39.8	3.8	1.56	0.020	0.0030	0.720	0.002	1.130	0.0180	6.9
19-May-93	I	10.0	92	92	16	2	743	8.24	46.0	2.7	1.63	0.024	0.0055	0.760	0.062	2.000	0.0260	6.0
2-Jun-93	I	12.5	680	680	80	2	705	8.23	50.4	5.6	2.99	0.030	0.0075	0.780	0.054	2.350	0.0380	5.6
16-Jun-93	I		1480	1460	120	2	782	8.33	49.5	9.1	4.71	0.028	0.0035	0.620	0.032	2.810	0.0590	4.1
23-Jun-93	D	16.0	1500	1490	200	4	760	8.26	50.8	5.3	2.30	0.034	0.0050	0.780	0.020	2.300	0.0414	6.3
30-Jun-93	D	17.0	6000	6000	380	2	788	8.29	50.5	10.3	5.24	0.032	0.0010	0.580	0.004	2.970	0.0370	3.9
7-Jul-93	D		3700	3700	370	2	779	8.28	49.5	6.4	3.37	0.032	0.0020	0.600	0.032	0.010	0.0440	3.7
14-Jul-93	D	20.0	6200	6200	570	2	780	8.36	51.3	6.9	2.71	0.030	0.0020	0.660	0.060	2.840	0.0520	3.6
21-Jul-93	D	19.0	6600	6600	800	4	771	8.30	47.5	10.4	5.58	0.038	0.0045	0.620	0.038	3.200	0.0590	3.7
26-Jul-93	W		260000	260000	36000	70	719	8.03	44.5	52.3	28.50	0.215	0.0250	1.500	0.122	2.850	0.0870	6.6
4-Aug-93	D	18.5	2500	2500	1220	2	757	8.27	50.2	11.6	2.79	0.038	0.0045	0.700	0.024	2.910	0.0680	3.7
11-Aug-93	W	20.0	7400	7300	1900	2	752	8.31	47.6	16.3	6.93	0.058	0.0070	0.740	0.002	2.760	0.0570	3.7
18-Aug-93	D	20.0	4300	4200	1900	4	765	8.30	48.9	11.3			0.0055		0.048	2.600	0.0620	3.6
25-Aug-25	D	20.0	5500	5100	1220	2	579	7.50	48.2	7.7	4.51	0.048	0.0065	0.680	0.070	2.360	0.0680	3.6
1-Sep-93	I	18.0	3800	3800	1280	2	777	8.38	51.9	16.6	8.43	0.066	0.0110	0.740	0.050	2.410	0.0610	3.6
8-Sep-93	I	13.0	910	880	130	2	804	8.30	47.9	3.8	2.19	0.018	0.0135	0.440	0.074	3.510	0.0520	3.2
15-Sep-93	W	18.0	1840	1700	480	2	798	8.15	51.3	4.2	3.05	0.038	0.0080	0.570	0.118	2.830	0.0670	3.4
MayGM/Avg		12.0	61	61	16	2	706	8.29	42.9	3.3	1.60	0.022	0.0043	0.740	0.032	1.565	0.0220	6.5
JunGM/Avg		15.2	1735	1726	164	2	759	8.28	50.3	7.6	3.81	0.031	0.0043	0.690	0.028	2.608	0.0439	5.0
JulyGM/Avg		19.5	14086	14086	1570	6	762	8.24	48.2	19.0	10.04	0.079	0.0084	0.845	0.063	2.225	0.0605	4.4
AugGM/Avg		19.6	4574	4447	1522	2	713	8.10	48.7	11.7	4.74	0.048	0.0059	0.707	0.036	2.658	0.0638	3.7
SepGM/Avg		16.3	1853	1785	431	2	793	8.28	50.4	8.2	4.56	0.041	0.0108	0.583	0.081	2.917	0.0600	3.4
SeasonGM/A		**16.9**	**2432**	2398	425	3	749	**8.23**	48.6	10.8	**5.41**	**0.047**	**0.0068**	**0.718**	**0.048**	2.461	**0.0527**	4.4
Dry Max		20.0	6600	6600	1900	4	788	8.36	51.3	11.6	5.58	0.048	0.0065	0.780	0.070	3.200	0.0680	6.3
3rd Quart		20.0	6050	6050	1220	4	779	8.30	50.6	10.6	4.88	0.038	0.0051	0.690	0.051	2.925	0.0635	3.8
Dry Median		19.0	4900	4650	685	2	768	8.29	49.9	9.0	3.37	0.034	0.0045	0.660	0.035	2.720	0.0555	3.7
Dry GM/Avg		**18.6**	**4105**	**4051**	**661**	**3**	**747**	**8.20**	**49.6**	**8.7**	**3.79**	**0.036**	**0.0039**	**0.660**	**0.037**	**2.399**	**0.0539**	**4.0**
1st Quart		17.8	3400	3400	378	2	759	8.27	48.7	6.8	2.75	0.032	0.0020	0.610	0.023	2.345	0.0434	3.6
Dry Min		16.0	1500	1490	200	2	579	7.50	47.5	5.3	2.30	0.030	0.0010	0.580	0.004	0.010	0.0370	3.6
Wet Max		20.0	260000	260000	36000	70	798	8.33	51.3	52.3	28.50	0.215	0.0250	1.500	0.122	2.850	0.0870	6.9
3rd Quart		19.0	70550	70475	10425	19	764	8.32	48.5	25.3	12.32	0.097	0.0123	0.930	0.119	2.835	0.0720	6.7
Wet Median		18.0	4620	4500	1190	36	736	8.23	46.1	10.3	4.99	0.048	0.0075	0.730	0.060	2.795	0.0620	5.2
Wet GM/Avg		**17.3**	**3450**	**3371**	**851**	**5**	**734**	**8.21**	**45.8**	**19.2**	**10.01**	**0.083**	**0.0108**	**0.883**	**0.061**	**2.393**	**0.0573**	**5.2**
1st Quart		16.0	1390	1285	364	53	706	8.12	43.3	4.1	2.68	0.034	0.0060	0.683	0.089	2.353	0.0473	3.6
Wet Min		14.0	40	40	16	2	668	8.03	39.8	3.8	1.56	0.020	0.0030	0.570	0.002	1.130	0.0180	3.4

Spencer Creek 1993 - STATION WE1B Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL, CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	mmo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
30-Jun-93	D	18.5	32000	32000	960	2	783	8.28	45.2	51.9	10.50	0.068	0.0025	1.580	0.188	2.670	0.0370	4.4
14-Jul-93	D		145000	145000	3100	24	790	7.75	44.3	59.6	39.70	0.175	0.0060	3.650	0.380	2.770	0.0470	5.0
25-Aug-93	D	20.0	1340	1170	1480	2	576	8.02	44.5	33.9	3.80	0.118	0.0025	1.140	0.048	2.860	0.0480	3.8
1-Sep-93	I	19.5	620	540	250	2	757	8.41	47.6	6.2	2.04	0.032	0.0035	0.560	0.006	2.870	0.0470	3.0
8-Sep-93	I	16.0	1110	1090	140	2	782	8.19	41.6	3.2	2.07	0.022	0.0120	0.420	0.026	3.050	0.0440	3.1
15-Sep-93	W	18.0	1340	1340	220	4	779	8.31	45.0	3.3	3.08	0.017	0.0050	0.430	0.016	3.260	0.0560	2.9
JunGM/Avg		18.5	32000	32000	960	2	783	8.28	45.2	51.9	10.50	0.068	0.0025	1.580	0.188	2.670	0.0370	4.4
JulyGM/Avg			145000	145000	3100	24	790	7.75	44.3	59.6	39.70	0.175	0.0060	3.650	0.380	2.770	0.0470	5.0
AugGM/Avg		20.0	1340	1170	1480	2	576	8.02	44.5	33.9	3.80	0.118	0.0025	1.140	0.048	2.860	0.0480	3.8
SepGM/Avg		17.8	973	924	197	3	773	8.30	44.7	4.2	2.40	0.024	0.0068	0.470	0.016	3.060	0.0490	3.0
SeasonGM/A		**18.4**	**4231**	**4030**	**569**	**3**	**745**	8.16	**44.7**	**26.4**	**10.20**	**0.072**	**0.0053**	**1.297**	**0.111**	**2.913**	**0.0465**	**3.7**
Dry Max		20.0	145000	145000	3100	24	790	8.28	45.2	59.6	39.70	0.175	0.0060	3.650	0.380	2.860	0.0480	5.0
3rd Quart		19.6	88500	88500	2290	13	787	8.15	44.9	55.8	25.10	0.147	0.0043	2.615	0.284	2.815	0.0475	4.7
Dry Median		19.3	32000	32000	1480	2	783	8.02	44.5	51.9	10.50	0.118	0.0025	1.580	0.188	2.770	0.0470	4.4
Dry GM/Avg		**19.3**	**18388**	**17575**	**1639**	**5**	**716**	**8.02**	**44.7**	**48.5**	**18.00**	**0.120**	**0.0037**	**2.123**	**0.205**	**2.767**	**0.0440**	**4.4**
1st Quart		18.9	16670	16585	1220	13	680	7.89	44.4	42.9	7.15	0.093	0.0043	1.360	0.118	2.720	0.0420	4.1
Dry Min		18.5	1340	1170	960	2	576	7.75	44.3	33.9	3.80	0.068	0.0025	1.140	0.048	2.670	0.0370	3.8
Wet Max		18.0	1340	1340	220	4	779	8.31	45.0	3.3	3.08	0.017	0.0050	0.430	0.016	3.260	0.0560	2.9
3rd Quart		18.0	1340	1340	220	4	779	8.31	45.0	3.3	3.08	0.017	0.0050	0.430	0.016	3.260	0.0560	2.9
Wet Median		18.0	1340	1340	220	4	779	8.31	45.0	3.3	3.08	0.017	0.0050	0.430	0.016	3.260	0.0560	2.9
Wet GM/Avg		**18.0**	**1340**	**1340**	**220**	**4**	**779**	**8.31**	**45.0**	**3.3**	**3.08**	**0.017**	**0.0050**	**0.430**	**0.016**	**3.260**	**0.0560**	**2.9**
1st Quart		18.0	1340	1340	220	4	779	8.31	45.0	3.3	3.08	0.017	0.0050	0.430	0.016	3.260	0.0560	2.9
Wet Min		18.0	1340	1340	220	4	779	8.31	45.0	3.3	3.08	0.017	0.0050	0.430	0.016	3.260	0.0560	2.9

APPENDIX E

Spencer Creek 1993 - STATION WE1A Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
30-Jun-93	D	17.0	2200	2200	300	2	748	8.14	34.9	4.4	2.22	0.026	0.0020	0.580	0.016	2.730	0.0260	3.8
14-Jul-93	D		3500	3500	700	2	727	8.01	30.4	10.1	4.46	0.048	0.0040	0.760	0.086	2.660	0.0360	3.4
26-Jul-93	W		7000	6900	12100	4	700	7.97	26.9	13.3	5.95	0.050	0.0070	0.680	0.102	2.770	0.0440	3.6
18-Aug-93	D	20.0	1640	1600	620	4	693	8.23	24.3	7.0			0.0035		0.026	3.240	0.0500	2.9
25-Aug-93	D	19.5	560	540	520	2	616	7.76	23.8	4.3	1.26	0.026	0.0055	0.480	0.036	3.210	0.0410	2.7
1-Sep-93	I	19.0	630	630	190	2	694	8.34	23.3	3.7	1.29	0.048	0.0120	0.680	0.034	2.800	0.0470	3.0
8-Sep-93	I		1100	1090	190	2												
15-Sep-93	W	17.5	760	750	170	2	675	8.34	22.6	4.2	3.66		0.0110		0.036	3.240	0.0450	2.7
JunGM/Avg		17.0	2200	2200	300	2	748	8.14	34.9	4.4	2.22	0.026	0.0020	0.580	0.016	2.730	0.0260	3.8
JulyGM/Avg			4950	4914	2910	3	714	7.99	28.7	11.7	5.21	0.049	0.0055	0.720	0.094	2.715	0.0400	3.5
AugGM/Avg		19.8	958	930	568	3	655	8.00	24.1	5.7	1.26	0.026	0.0045	0.480	0.031	3.225	0.0455	2.8
SepGM/Avg		18.3	808	802	183	2	685	8.34	23.0	4.0	2.48	0.048	0.0115	0.680	0.035	3.020	0.0460	2.9
SeasonGM/A		18.6	1503	1485	516	2	693	8.11	26.6	6.7	3.14	0.040	0.0064	0.636	0.048	2.950	0.0413	3.2
Dry Max		20.0	3500	3500	700	4	748	8.23	34.9	10.1	4.46	0.048	0.0055	0.760	0.086	3.240	0.0500	3.8
3rd Quart		19.8	2525	2525	640	3	732	8.16	31.5	7.8	3.34	0.037	0.0044	0.670	0.049	3.218	0.0433	3.5
Dry Median		19.5	1920	1900	570	2	710	8.08	27.4	5.7	2.22	0.026	0.0038	0.580	0.031	2.970	0.0385	3.2
Dry GM/Avg		18.8	1631	1606	510	2	696	8.04	28.4	6.5	2.65	0.033	0.0038	0.607	0.041	2.960	0.0383	3.2
1st Quart		18.3	1370	1335	465	4	674	7.95	24.2	4.4	1.74	0.037	0.0031	0.530	0.024	2.713	0.0335	2.9
Dry Min		17.0	560	540	300	2	616	7.76	23.8	4.3	1.26	0.026	0.0020	0.480	0.016	2.660	0.0260	2.7
Wet Max		17.5	7000	6900	12100	4	700	8.34	26.9	13.3	5.95	0.050	0.0110	0.680	0.102	3.240	0.0450	3.6
3rd Quart		17.5	5440	5363	9118	4	694	8.25	25.8	11.0	5.38	0.050	0.0100	0.680	0.086	3.123	0.0448	3.4
Wet Median		17.5	3880	3825	6135	3	688	8.16	24.8	8.8	4.81	0.050	0.0090	0.680	0.069	3.005	0.0445	3.2
Wet GM/Avg		17.5	2307	2275	1434	3	688	8.16	24.8	8.8	4.81	0.050	0.0090	0.680	0.069	3.005	0.0445	3.2
1st Quart		17.5	2320	2288	3153	3	681	8.06	23.7	6.5	4.23	0.050	0.0080	0.680	0.053	2.888	0.0443	2.9
Wet Min		17.5	760	750	170	2	675	7.97	22.6	4.2	3.66	0.050	0.0070	0.680	0.036	2.770	0.0440	2.7

Spencer Creek 1993 - STATION WE2 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
30-Jun-93	D	17.0	50	50	140	2	604	8.15	36.9	7.2	5.56	0.042	0.0120	0.500	0.016	0.805	0.0110	4.6
7-Jul-93	D		940	940	120	2	620	8.08	43.3	8.1	13.10	0.096	0.0230	0.720	0.136	0.380	0.0150	4.4
21-Jul-93	D	24.0	500	500	420	4	771	8.30	74.8	25.7	14.10	0.210	0.0145	1.760	0.008	0.005	0.0040	7.0
26-Jul-93	W		140	140	560	4	613	8.11	48.6	18.9	11.00	0.162	0.0055	1.340	0.070	0.010	0.0040	6.3
4-Aug-93	D	22.5	520	520	40	2	580	8.36	37.5	21.3	12.10	0.116	0.0050	1.000	0.002	0.005	0.0020	5.7
11-Aug-93	W		1950	1950	790	2	694	8.22	25.8	6.9	2.12	0.040	0.0055	0.560	0.004	2.930	0.0400	3.0
JunGM/Avg		17.0	50	50	140	2	604	8.15	36.9	7.2	5.56	0.042	0.0120	0.500	0.016	0.805	0.0110	4.6
JulyGM/Avg		24.0	404	404	304	3	668	8.16	55.6	17.6	12.73	0.156	0.0143	1.273	0.071	0.132	0.0077	5.9
AugGM/Avg		22.5	1007	1007	178	2	637	8.29	31.7	14.1	7.11	0.078	0.0053	0.780	0.003	1.468	0.0210	4.4
SepGM/Avg																		
SeasonGM/A		21.2	387	387	224	3	647	8.20	44.5	14.7	9.66	0.111	0.0109	0.980	0.039	0.689	0.0127	5.2
Dry Max		24.0	940	940	420	4	771	8.36	74.8	25.7	14.10	0.210	0.0230	1.760	0.136	0.805	0.0150	7.0
3rd Quart		23.3	625	625	210	3	658	8.32	51.2	22.4	13.35	0.140	0.0166	1.190	0.046	0.486	0.0120	6.0
Dry Median		22.5	510	510	130	2	612	8.23	40.4	14.7	12.60	0.106	0.0133	0.860	0.012	0.193	0.0075	5.2
Dry GM/Avg		21.2	332	332	130	2	644	8.22	48.1	15.6	11.22	0.116	0.0136	0.995	0.041	0.299	0.0080	5.4
1st Quart		19.8	388	388	100	4	598	8.13	37.4	7.9	10.47	0.083	0.0103	0.665	0.007	0.286	0.0035	4.6
Dry Min		17.0	50	50	40	2	580	8.08	36.9	7.2	5.56	0.042	0.0050	0.500	0.002	0.005	0.0020	4.4
Wet Max			1950	1950	790	4	694	8.22	48.6	18.9	11.00	0.162	0.0055	1.340	0.070	2.930	0.0400	6.3
3rd Quart			1498	1498	733	4	674	8.19	42.9	15.9	8.78	0.132	0.0055	1.145	0.054	2.200	0.0310	5.5
Wet Median			1045	1045	675	3	654	8.17	37.2	12.9	6.56	0.101	0.0055	0.950	0.037	1.470	0.0220	4.7
Wet GM/Avg			522	522	665	3	654	8.17	37.2	12.9	6.56	0.101	0.0055	0.950	0.037	1.470	0.0220	4.7
1st Quart			593	593	618	3	633	8.14	31.5	9.9	4.34	0.071	0.0055	0.755	0.021	0.740	0.0130	3.8
Wet Min			140	140	560	2	613	8.11	25.8	6.9	2.12	0.040	0.0055	0.560	0.004	0.010	0.0040	3.0

APPENDIX E

Spencer Creek 1993 - STATION SP3 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		˚C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	mmo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
4-May-93	W	15.0	44	44	40	2	541	8.31	29.0	4.6	1.68	0.022	0.0010	0.660	0.014	0.350	0.0130	9.2
19-May-93	I	10.5	96	96	16	2	588	8.39	32.2	4.3	1.76	0.024	0.0025	0.660	0.020	0.685	0.0110	8.3
2-Jun-93	I	12.5	348	348	68	2	537	8.41	31.9	7.8	2.60	0.028	0.0020	0.660	0.002	0.530	0.0080	7.8
16-Jun-93	I		408	408	32	2	564	8.39	30.6	6.4	2.54	0.030	0.0040	0.720	0.036	0.480	0.0140	8.4
23-Jun-93	D	17.0	1450	1430	350	4	516	8.27	26.4	9.5	3.49	0.050	0.0090	0.860	0.026	0.235	0.0090	12.1
30-Jun-93	D	18.5	1010	950	280	2	524	8.31	25.3	5.6	2.60	0.036	0.0075	0.760	0.008	0.240	0.0070	11.2
7-Jul-93	D		800	800	200	4	567	8.42	32.3	9.0	2.86	0.036	0.0025	0.720	0.002	0.525	0.0170	8.7
14-Jul-93	D		1680	1680	290	2	564	8.31	33.3	11.3	4.00	0.048	0.0010	0.720	0.020	0.300	0.0080	7.6
21-Jul-93	D	21.5	1300	1280	550	4	541	8.45	31.4	9.1	3.71	0.038	0.0060	0.600	0.002	0.255	0.0060	7.9
26-Jul-93	W		6200	6100	7500	4	531	8.16	29.8	17.8	7.97	0.050	0.0035	1.000	0.048	0.515	0.0130	8.5
4-Aug-93	D	20.0	960	960	150	2	533	8.54	29.0	7.4	2.48	0.032	0.0200	0.740	0.080	0.145	0.0070	11.7
11-Aug-93	W	20.0	1120	1120	360	52	561	8.49	33.1	7.3	2.20	0.030	0.0020	0.660	0.006	0.325	0.0100	8.1
18-Aug-93	D	21.0	580	580	60	4	579	8.42	35.9	6.4	3.73		0.0145		0.020	0.475	0.0140	7.7
25-Aug-25	D	20.0	700	680	340	1	533	7.82	40.0	8.9	3.49	0.044	0.0100	0.640	0.030	0.525	0.0120	6.5
1-Sep-93	I	19.5	500	480	270	2	566	8.53	39.0	13.9	3.29	0.044	0.0135	0.620	0.014	0.295	0.0090	6.6
8-Sep-93	I	14.5	590	560	360	2	554	8.32	29.6	6.2	2.85	0.036	0.0180	0.680	0.014	0.210	0.0070	12.0
15-Sep-93	W	19.0	1050	1050	270	2	554	8.38	30.2	4.4	2.73	0.031	0.0075	0.630	0.008	0.170	0.0060	10.7
MayGM/Avg		12.8	65	65	25	2	565	8.35	30.6	4.5	1.72	0.023	0.0018	0.660	0.017	0.518	0.0120	8.8
JunGM/Avg		16.0	675	663	121	2	535	8.35	28.6	7.3	2.81	0.036	0.0056	0.750	0.018	0.371	0.0095	9.9
JulyGM/Avg		21.5	1814	1800	699	3	551	8.34	31.7	11.8	4.64	0.043	0.0033	0.760	0.018	0.399	0.0110	8.2
AugGM/Avg		20.3	813	807	182	5	552	8.32	34.5	7.5	2.98	0.035	0.0116	0.680	0.034	0.368	0.0108	8.5
SepGM/Avg		17.7	677	656	297	2	558	8.41	32.9	8.2	2.96	0.037	0.0130	0.643	0.012	0.225	0.0073	9.8
SeasonGM/A		**17.6**	**676**	**667**	196	3	550	8.35	31.7	8.2	3.18	**0.036**	**0.0073**	**0.708**	**0.021**	**0.368**	**0.0101**	9.0
Dry Max		21.5	1680	1680	550	4	579	8.54	40.0	11.3	4.00	0.050	0.0200	0.860	0.080	0.525	0.0170	12.1
3rd Quart		20.8	1338	1318	343	4	565	8.43	34.0	9.2	3.72	0.046	0.0111	0.750	0.027	0.488	0.0125	11.3
Dry Median		20.0	985	955	285	3	537	8.37	31.9	9.0	3.49	0.038	0.0083	0.720	0.020	0.278	0.0085	8.3
Dry GM/Avg		**19.7**	**1000**	985	**236**	3	**545**	8.32	31.7	8.4	3.30	**0.041**	**0.0088**	**0.720**	**0.024**	**0.338**	**0.0100**	9.2
1st Quart		18.9	775	770	188	2	531	8.30	28.4	7.2	2.80	0.036	0.0051	0.680	0.007	0.239	0.0070	7.7
Dry Min		17.0	580	580	60	1	516	7.82	25.3	5.6	2.48	0.032	0.0010	0.600	0.002	0.145	0.0060	6.5
Wet Max		20.0	6200	6100	7500	52	561	8.49	33.1	17.8	7.97	0.050	0.0075	1.000	0.048	0.515	0.0130	10.7
3rd Quart		19.5	2390	2365	2145	16	556	8.41	30.9	9.9	4.04	0.036	0.0045	0.745	0.023	0.391	0.0130	9.6
Wet Median		19.0	1085	1085	315	3	548	8.35	30.0	6.0	2.47	0.031	0.0028	0.660	0.011	0.338	0.0115	8.9
Wet GM/Avg		**18.0**	753	750	413	5	**547**	8.34	30.5	8.5	3.65	**0.033**	**0.0035**	**0.738**	**0.019**	**0.340**	**0.0105**	9.1
1st Quart		17.0	799	799	213	4	539	8.27	29.6	4.6	2.07	0.028	0.0018	0.653	0.008	0.286	0.0090	8.4
Wet Min		15.0	44	44	40	2	531	8.16	29.0	4.4	1.68	0.022	0.0010	0.630	0.006	0.170	0.0060	8.1

Spencer Creek 1993 - STATION FA2 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL, CHEMICAL DATA											
DATE		˚C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	phoru	Pphate	T.K.N.	mmo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
30-Jun-93	D	14.5	770	770	490	2	644	8.16	43.1	4.3	2.04	0.036	0.0100	0.740	0.002	1.940	0.0170	7.0
7-Jul-93	D		880	880	570	2	644	8.26	45.0	3.5	2.22	0.036	0.0085	0.640	0.020	2.380	0.0300	4.5
14-Jul-93	D		930	920	470	2	641	8.13	46.3	4.7	2.15	0.026	0.0120	0.500	0.010	2.390	0.0100	3.1
21-Jul-93	D	17.0	1440	1440	360	4	648	8.28	44.4	4.6	2.26	0.046	0.0170	0.740	0.004	2.280	0.0170	4.5
26-Jul-93	W		26000	26000	16000	4	520	8.04	35.9	48.9	26.30	0.152	0.0135	1.620	0.116	1.960	0.0220	4.1
4-Aug-93	D	16.0	680	640	560	2	653	8.28	48.4	5.3	2.18	0.040	0.0190	0.980	0.026	2.530	0.0250	4.8
11-Aug-93	W	17.0	3700	3700	3100	2	624	8.33	47.7	7.3	3.20	0.042	0.0350	0.640	0.016	2.010	0.0110	3.3
18-Aug-93	D	18.0	1400	1400	700	10	639	8.33	50.6	17.2	9.45		0.0200		0.040	2.010	0.0130	3.0
25-Aug-25	D	18.5	860	850	1050	2	540	7.72	51.7	3.1	1.44	0.036	0.0165	0.460	0.022	1.790	0.0060	2.8
1-Sep-93	I	16.5	670	660	270	2	648	8.49	52.3	3.6	1.96	0.048	0.0305	0.480	0.018	1.940	0.0070	2.9
8-Sep-93	I	11.0	300	300	340	2	701	8.34	44.7	7.8	3.11	0.048	0.0260	0.680	0.026	1.520	0.0080	6.1
15-Sep-93	W	18.0	570	550	220	2	674	8.34	49.2	4.9	2.08	0.037	0.0220	0.510	0.010	1.690	0.0060	4.4
MayGM/Avg																		
JunGM/Avg		14.5	770	770	490	2	644	8.16	43.1	4.3	2.04	0.036	0.0100	0.740	0.002	1.940	0.0170	7.0
JulyGM/Avg		17.0	2353	2346	1115	3	613	8.18	42.9	15.4	8.23	0.065	0.0128	0.875	0.038	2.253	0.0198	4.1
AugGM/Avg		17.4	1319	1296	1063	3	614	8.17	49.6	8.2	4.07	0.039	0.0226	0.693	0.026	2.085	0.0138	3.5
SepGM/Avg		15.2	486	478	272	2	674	8.39	48.7	5.4	2.38	0.044	0.0262	0.557	0.018	1.717	0.0070	4.5
SeasonGM/A		**16.3**	**1192**	1178	720	3	631	8.23	**46.6**	9.6	4.87	**0.050**	**0.0192**	0.726	**0.026**	**2.037**	**0.0143**	4.2
Dry Max		18.5	1440	1440	1050	10	653	8.33	51.7	17.2	9.45	0.046	0.0200	0.980	0.040	2.530	0.0300	7.0
3rd Quart		18.0	1165	1160	635	3	646	8.28	49.5	5.0	2.24	0.039	0.0180	0.740	0.024	2.385	0.0210	4.7
Dry Median		17.0	880	880	560	2	644	8.26	46.3	4.6	2.18	0.036	0.0165	0.690	0.020	2.280	0.0170	4.5
Dry GM/Avg		**16.8**	**958**	**947**	570	3	630	8.17	47.1	6.1	3.11	**0.037**	**0.0147**	**0.677**	**0.018**	**2.189**	**0.0169**	4.2
1st Quart		16.0	815	810	480	2	640	8.15	44.7	3.9	2.10	0.036	0.0110	0.535	0.007	1.975	0.0115	3.1
Dry Min		14.5	680	640	360	2	540	7.72	43.1	3.1	1.44	0.026	0.0085	0.460	0.002	1.790	0.0060	2.8
Wet Max		18.0	26000	26000	16000	4	674	8.34	49.2	48.9	26.30	0.152	0.0350	1.620	0.116	2.010	0.0220	4.4
3rd Quart		17.8	14850	14850	9550	3	649	8.34	48.5	28.1	14.75	0.097	0.0285	1.130	0.066	1.985	0.0165	4.3
Wet Median		17.5	3700	3700	3100	2	624	8.33	47.7	7.3	3.20	0.042	0.0220	0.640	0.016	1.960	0.0110	4.1
Wet GM/Avg		**17.5**	**3799**	**3754**	**2218**	3	**606**	**8.24**	**44.3**	**20.4**	**10.53**	**0.077**	**0.0235**	**0.923**	**0.047**	**1.887**	**0.0130**	**3.9**
1st Quart		17.3	2135	2125	1660	3	572	8.19	41.8	6.1	2.64	0.040	0.0178	0.575	0.013	1.825	0.0085	3.7
Wet Min		17.0	570	550	220	2	520	8.04	35.9	4.9	2.08	0.037	0.0135	0.510	0.010	1.690	0.0060	3.3

APPENDIX E

Spencer Creek 1993 - STATION SP4 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	esP	Turbid	phoru	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
4-May-93	W	14.0	116	116	60	2	507	8.39	25.4	4.5	1.59	0.022	0.0010	0.620	0.010	0.285	0.0110	8.7
19-May-93	I	10.5	44	44	40	2	563	8.40	30.0	3.1	1.76	0.016	0.0015	0.540	0.012	0.400	0.0060	7.4
2-Jun-93	I	11.0	220	216	112	4	513	8.38	29.0	4.7	2.20	0.018	0.0020	0.560	0.002	0.285	0.0040	8.1
16-Jun-93	I		276	268	72	2	535	8.43	28.9	3.5	1.26	0.028	0.0010	0.580	0.008	0.090	0.0050	8.3
23-Jun-93	D	17.0	1400	1400	2400	4	488	8.30	22.7	13.4	3.66	0.044	0.0020	0.860	0.008	0.045	0.0050	13.1
30-Jun-93	D	17.5	1160	1150	320	2	509	8.33	23.8	5.1	1.61	0.028	0.0010	0.700	0.006	0.035	0.0050	11.2
7-Jul-93	D		2340	2320	420	2	549	8.34	29.8	5.6	2.25	0.032	0.0040	0.640	0.010	0.165	0.0060	9.1
14-Jul-93	D		1660	1640	510	4	528	8.28	29.7	5.1	1.66	0.030	0.0090	0.620	0.010	0.080	0.0050	8.8
21-Jul-93	D	20.0	1920	1840	330	4	512	8.39	27.8	7.7	2.67	0.028	0.0020	0.700	0.002	0.050	0.0040	9.7
26-Jul-93	W		9000	9000	25000	8	524	8.23	29.3	21.9	7.36	0.070	0.0070	0.820	0.030	0.130	0.0070	9.5
4-Aug-93	D	18.5	1160	1140	310	2	535	8.37	27.6	5.3	1.75	0.106	0.0045	0.740	0.002	0.060	0.0050	12.4
11-Aug-93	W	19.0	8900	8900	3600	2	554	8.42	31.7		1.38	0.044	0.0110	0.580	0.004	0.075	0.0060	8.5
18-Aug-93	D	20.0	1200	1200	2700	40	583	8.40	35.2	5.2	2.88		0.0255		0.010	0.125	0.0050	7.9
25-Aug-25	D	20.0	4000	3900	2100	4	404	7.90	39.4	4.8	1.79		0.0250		0.018	0.075	0.0050	6.9
1-Sep-93	I	18.5	1700	1680	880	2	551	8.53	35.8		1.07	0.038	0.0180	0.500	0.012	0.115	0.0060	7.1
8-Sep-93	I	13.5	2800	2750	420	2	540	8.42	28.3	5.8	2.34	0.036	0.0180	0.720	0.006	0.115	0.0070	12.4
15-Sep-93	W	19.0	2600	2550	540	6	547	8.39	29.2	4.1			0.0125		0.010	0.115	0.0060	11.1
MayGM/Avg		12.3	71	71	49	2	535	8.40	27.7	3.8	1.68	0.019	0.0013	0.580	0.011	0.343	0.0085	8.1
JunGM/Avg		15.2	560	553	281	3	511	8.36	26.1	6.7	2.18	0.030	0.0015	0.675	0.006	0.114	0.0048	10.2
JulyGM/Avg		20.0	2862	2817	1153	4	528	8.31	29.2	10.1	3.49	0.040	0.0055	0.695	0.013	0.106	0.0055	9.3
AugGM/Avg		19.4	2653	2625	1586	5	519	8.27	33.5	5.1	1.95	0.075	0.0165	0.660	0.009	0.084	0.0053	8.9
SepGM/Avg		17.0	2313	2275	584	3	546	8.45	31.1	5.0	1.71	0.037	0.0162	0.610	0.009	0.115	0.0063	10.2
SeasonGM/A		16.8	1195	1180	545	3	526	8.35	29.6	6.7	2.33	0.039	0.0085	0.656	0.009	0.132	0.0058	9.4
Dry Max		20.0	4000	3900	2700	40	583	8.40	39.4	13.4	3.66	0.106	0.0255	0.860	0.018	0.165	0.0060	13.1
3rd Quart		20.0	2025	1960	2175	4	539	8.38	31.2	6.1	2.72	0.041	0.0130	0.730	0.010	0.091	0.0050	11.5
Dry Median		19.3	1530	1520	465	4	520	8.34	28.8	5.3	2.02	0.031	0.0043	0.700	0.009	0.068	0.0050	9.4
Dry GM/Avg		18.8	1693	1669	746	4	514	8.29	29.5	6.5	2.28	0.045	0.0091	0.710	0.008	0.079	0.0050	9.9
1st Quart		17.8	1190	1188	328	2	504	8.30	26.7	5.1	1.73	0.029	0.0020	0.655	0.005	0.049	0.0050	8.6
Dry Min		17.0	1160	1140	310	2	404	7.90	22.7	4.8	1.61	0.028	0.0010	0.620	0.002	0.035	0.0040	6.9
Wet Max		19.0	9000	9000	25000	8	554	8.42	31.7	21.9	7.36	0.070	0.0125	0.820	0.030	0.285	0.0110	11.1
3rd Quart		19.0	8925	8925	8950	7	549	8.40	29.9	13.2	4.48	0.057	0.0114	0.720	0.015	0.169	0.0080	9.9
Wet Median		19.0	5750	5725	2070	4	536	8.39	29.3	4.5	1.59	0.044	0.0090	0.620	0.010	0.123	0.0065	9.1
Wet GM/Avg		17.3	2217	2206	1307	4	533	8.36	28.9	10.2	3.44	0.045	0.0079	0.673	0.014	0.151	0.0075	9.5
1st Quart		16.5	1979	1942	420	5	520	8.35	28.3	4.3	1.49	0.033	0.0055	0.600	0.009	0.105	0.0068	8.7
Wet Min		14.0	116	116	60	2	507	8.23	25.4	4.1	1.38	0.022	0.0010	0.580	0.004	0.075	0.0060	8.5

Spencer Creek 1993 - STATION SP4A Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
11-Aug-93	W	20.0	9700	9600	3700	2	540	8.46	31.2	4.9	0.94	0.036	0.0010	0.580	0.002	0.015	0.0050	8.4
18-Aug-93	D		6700	6700	2380	4	574	8.46	35.3	4.3	1.78		0.0210		0.016	0.070	0.0050	7.7
25-Aug-25	D	20.0	4000	4000	3200	2	537	7.88	39.5	2.8	1.02	0.036	0.0125	0.500	0.020	0.005	0.0040	6.5
1-Sep-93	I	18.5	5500	5500	1380	2	551	8.53	36.3	2.2	0.78	0.064	0.0175	1.060	0.010	0.070	0.0050	7.2
8-Sep-93	I	13.5	3600	3600	640	4	544	8.41	28.3	6.2	2.08	0.042	0.0155	0.700	0.014	0.080	0.0050	12.5
15-Sep-93	W	18.5	11800	11700	1000	4	549	8.34	29.2	4.4	2.62		0.0080		0.004	0.100	0.0060	10.9
MayGM/Avg																		
JunGM/Avg																		
JulyGM/Avg																		
AugGM/Avg		20.0	6382	6360	3043	3	550	8.27	35.3	4.0	1.25	0.036	0.0115	0.540	0.013	0.030	0.0047	7.5
SepGM/Avg		16.8	6159	6142	959	3	548	8.43	31.3	4.3	1.83	0.053	0.0137	0.880	0.009	0.083	0.0053	10.2
SeasonGM/A		18.1	6270	6250	1709	3	549	8.35	33.3	4.1	1.54	0.045	0.0126	0.710	0.011	0.057	0.0050	8.9
Dry Max		20.0	6700	6700	3200	4	574	8.46	39.5	4.3	1.78	0.036	0.0210	0.500	0.020	0.070	0.0050	7.7
3rd Quart		20.0	6025	6025	2995	4	565	8.32	38.5	3.9	1.59	0.036	0.0189	0.500	0.019	0.054	0.0048	7.4
Dry Median		20.0	5350	5350	2790	3	556	8.17	37.4	3.6	1.40	0.036	0.0168	0.500	0.018	0.038	0.0045	7.1
Dry GM/Avg		20.0	5177	5177	2760	3	556	8.17	37.4	3.6	1.40	0.036	0.0168	0.500	0.018	0.038	0.0045	7.1
1st Quart		20.0	4675	4675	2585	3	546	8.03	36.4	3.2	1.21	0.036	0.0146	0.500	0.017	0.021	0.0043	6.8
Dry Min		20.0	4000	4000	2380	2	537	7.88	35.3	2.8	1.02	0.036	0.0125	0.500	0.016	0.005	0.0040	6.5
Wet Max		20.0	11800	11700	3700	4	549	8.46	31.2	4.9	2.62	0.036	0.0080	0.580	0.004	0.100	0.0060	10.9
3rd Quart		19.6	11275	11175	3025	4	547	8.43	30.7	4.8	2.20	0.036	0.0063	0.580	0.004	0.079	0.0058	10.3
Wet Median		19.3	10750	10650	2350	3	545	8.40	30.2	4.7	1.78	0.036	0.0045	0.580	0.003	0.058	0.0055	9.7
Wet GM/Avg		19.3	10699	10598	1924	3	545	8.40	30.2	4.7	1.78	0.036	0.0045	0.580	0.003	0.058	0.0055	9.7
1st Quart		18.9	10225	10125	1675	3	542	8.37	29.7	4.5	1.36	0.036	0.0028	0.580	0.003	0.036	0.0053	9.0
Wet Min		18.5	9700	9600	1000	2	540	8.34	29.2	4.4	0.94	0.036	0.0010	0.580	0.002	0.015	0.0050	8.4

APPENDIX E

Spencer Creek 1993 - STATION SP5 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		˚C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
4-May-93	W	14.5	60	60	16	2	501	8.23	24.7	3.9	1.92	0.020	0.0010	0.620	0.036	0.230	0.0090	8.9
19-May-93	I	11.0	72	72	52	2	567	8.31	30.2	3.0	1.44	0.022	0.0015	0.560	0.026	0.410	0.0070	7.6
2-Jun-93	I	12.5	164	164	52	2	507	8.35	28.3	1.8	0.94	0.012	0.0015	0.540	0.002	0.240	0.0070	8.1
16-Jun-93	I		112	108	4	2	549	8.34	29.9	3.7	1.88	0.024	0.0015	0.600	0.026	0.015	0.0060	8.4
23-Jun-93	D		170	170	120	4	482	8.27	22.0	3.9	1.51	0.028	0.0010	0.780	0.018	0.010	0.0050	14.0
30-Jun-93	D	18.5	40	40	110	2	511	8.25	24.0	2.2	0.66	0.030	0.0015	0.720	0.006	0.030	0.0050	11.3
7-Jul-93	D	28.0	350	350	120	2	562	8.25	31.5	6.6	1.59	0.042	0.0075	0.680	0.060	0.035	0.0100	9.3
14-Jul-93	D	23.0	120	120	100	2	539	8.05	29.3	3.5	1.33	0.032	0.0100	0.700	0.056	0.040	0.0070	9.9
21-Jul-93	D	22.0	150	140	70	4	515	8.32	27.7	3.5	1.17	0.026	0.0070	2.600	0.022	0.045	0.0060	10.8
26-Jul-93	W		1400	1400	2500	4	556	7.99	33.3	2.6	1.24	0.036	0.0040	0.660	0.048	0.070	0.0090	8.9
4-Aug-93	D	20.0	140	140	90	2	541	8.24	28.2	3.2	1.14	0.050	0.0075	0.580	0.010	0.065	0.0100	12.4
11-Aug-93	W	21.0	110	110	550	2	567	8.25	33.3	2.3	0.87	0.030	0.0070	0.580	0.018	0.050	0.0140	8.2
18-Aug-93	D	23.0	20	20	70	4	588	8.23	36.9	2.6	1.07	0.056	0.0245	0.600	0.046	0.030	0.0120	7.6
25-Aug-25	D	22.0	10	10	60	2	453	7.83	41.4	2.0	0.71	0.034	0.0130	0.520	0.026	0.020	0.0080	6.5
1-Sep-93	I	20.0	50	50	110	2	567	8.31	35.2	2.9	1.23	0.032	0.0100	0.680	0.088	0.015	0.0120	8.0
8-Sep-93	I	14.5	80	80	110	2	550	8.15	28.4	3.7	1.75	0.030	0.0170	0.660	0.048	0.110	0.0110	12.9
15-Sep-93	W	19.0	240	240	60	2	547	8.47	29.6	1.7	1.63		0.0105		0.060	0.090	0.0130	11.1
MayGM/Avg		12.8	66	66	29	2	534	8.27	27.5	3.5	1.68	0.021	0.0013	0.590	0.031	0.320	0.0080	8.3
JunGM/Avg		15.5	106	105	41	2	512	8.30	26.1	2.9	1.25	0.024	0.0014	0.660	0.013	0.074	0.0058	10.5
JulyGM/Avg		24.3	306	301	214	3	543	8.15	30.5	4.1	1.33	0.034	0.0071	1.160	0.047	0.048	0.0080	9.7
AugGM/Avg		21.5	42	42	120	2	537	8.14	35.0	2.5	0.95	0.043	0.0130	0.570	0.025	0.041	0.0110	8.7
SepGM/Avg		17.8	99	99	90	2	555	8.31	31.1	2.8	1.54	0.031	0.0125	0.670	0.065	0.072	0.0120	10.7
SeasonGM/A		**19.2**	**102**	**101**	**86**	**2**	**535**	**8.23**	**30.2**	**3.1**	**1.30**	**0.032**	**0.0074**	**0.755**	**0.035**	**0.089**	**0.0089**	**9.6**
Dry Max		28.0	350	350	120	4	588	8.32	41.4	6.6	1.59	0.056	0.0245	2.600	0.060	0.065	0.0120	14.0
3rd Quart		25.5	155	148	113	4	546	8.26	32.9	3.6	1.38	0.044	0.0108	0.735	0.049	0.041	0.0100	11.6
Dry Median		22.0	130	130	95	2	527	8.25	28.8	3.4	1.16	0.033	0.0075	0.690	0.024	0.033	0.0075	10.4
Dry GM/Avg		**22.4**	**77**	**76**	**90**	**3**	**524**	**8.18**	**30.1**	**3.4**	**1.15**	**0.037**	**0.0090**	**0.898**	**0.031**	**0.034**	**0.0079**	**10.2**
1st Quart		21.0	35	35	70	2	504	8.19	26.8	2.5	0.98	0.030	0.0056	0.595	0.016	0.028	0.0058	8.9
Dry Min		18.5	10	10	60	2	453	7.83	22.0	2.0	0.66	0.026	0.0010	0.520	0.006	0.010	0.0050	6.5
Wet Max		21.0	1400	1400	2500	4	567	8.47	33.3	3.9	1.92	0.036	0.0105	0.660	0.060	0.230	0.0140	11.1
3rd Quart		20.0	530	530	1038	3	559	8.31	33.3	2.9	1.70	0.033	0.0079	0.640	0.051	0.125	0.0133	9.5
Wet Median		19.0	175	175	305	2	552	8.24	31.5	2.5	1.44	0.030	0.0055	0.620	0.042	0.080	0.0110	8.9
Wet GM/Avg		**18.2**	**217**	**217**	**191**	**2**	**543**	**8.24**	**30.2**	**2.6**	**1.42**	**0.029**	**0.0056**	**0.620**	**0.041**	**0.110**	**0.0113**	**9.3**
1st Quart		16.8	98	98	49	4	536	8.17	28.4	2.2	1.15	0.025	0.0033	0.600	0.032	0.065	0.0120	8.7
Wet Min		14.5	60	60	16	2	501	7.99	24.7	1.7	0.87	0.020	0.0010	0.580	0.018	0.050	0.0090	8.2

Spencer Creek 1993 - STATION SP6 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL, CHEMICAL DATA											
DATE		˚C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
19-May-93	I	10.0	36	36	28	2	568	8.18	29.4	2.8	1.50	0.022	0.0010	0.580	0.020	0.735	0.0080	7.2
2-Jun-93	I	12.5	84	80	68	2	508	8.16	27.6	2.0	0.85	0.020	0.0015	0.560	0.002	0.340	0.0070	8.2
16-Jun-93	I		136	136	40	2	568	8.26	30.2	2.2	0.82	0.030	0.0075	0.580	0.018	0.335	0.0160	7.4
23-Jun-93	D		200	200	130	4	496	8.06	22.2	3.0	0.95	0.054	0.0225	0.800	0.018	0.060	0.0070	14.1
30-Jun-93	D	17.0	270	240	210	2	520	8.28	24.8	2.3	0.90	0.042	0.0195	0.720	0.024	0.235	0.0090	10.3
7-Jul-93	D		670	660	160	2	597	8.16	33.2	2.8	1.03	0.062	0.0245	0.680	0.088	0.450	0.0240	7.3
14-Jul-93	D	20.0	200	200	90	2	565	8.16	30.0	2.7	0.96	0.056	0.0325	0.660	0.062	0.290	0.0170	9.6
21-Jul-93	D	20.0	150	140	70	4	515	8.32	27.7	3.5	1.17	0.026	0.0070	2.600	0.022	0.045	0.0060	10.8
26-Jul-93	W		3200	3200	3400	4	554	7.93	31.0	6.7	2.34	0.062	0.0270	0.780	0.106	0.480	0.0210	7.9
4-Aug-93	D	19.0	390	380	120	2	559	8.08	29.1	3.2	0.95		0.0305		0.052	0.310	0.0110	11.8
11-Aug-93	W	20.0	690	690	440	2	596	8.22	35.1	4.0	1.52	0.046	0.0205	0.580	0.030	0.530	0.0160	6.6
18-Aug-93	D	21.0	190	180	90	4	622	8.25	38.4	2.7	1.18	0.074	0.0380	0.580	0.062	0.440	0.0200	6.0
25-Aug-25	D	19.0	150	140	70	2	432	7.81	42.9	2.8	0.98	0.052	0.0370	0.420	0.076	0.495	0.0200	4.5
1-Sep-93	I	20.0	320	290	250	2	599	8.28	38.0	8.0	1.46	0.066	0.0375	0.620	0.064	0.190	0.0140	7.8
8-Sep-93	I	13.5	230	230	280	2	555	8.15	28.7	1.8	0.91	0.048	0.0235	0.760	0.018	0.195	0.0090	12.5
15-Sep-93	W	19.0	350	330	280	2	562	8.31	30.2	1.3	1.03	0.051	0.0270	0.610	0.034	0.255	0.0100	11.0
MayGM/Avg		10.0	36	36	28	2	568	8.18	29.4	2.8	1.50	0.022	0.0010	0.580	0.020	0.735	0.0080	7.2
JunGM/Avg		14.8	158	151	93	2	523	8.19	26.2	2.4	0.88	0.037	0.0128	0.665	0.016	0.243	0.0098	10.0
JulyGM/Avg		20.0	504	493	242	3	558	8.14	30.5	3.9	1.38	0.052	0.0228	1.180	0.070	0.316	0.0170	8.9
AugGM/Avg		19.8	296	285	135	2	552	8.09	36.4	3.2	1.16	0.057	0.0315	0.527	0.055	0.444	0.0168	7.2
SepGM/Avg		17.5	295	280	270	2	572	8.25	32.3	3.7	1.13	0.055	0.0293	0.663	0.039	0.213	0.0110	10.4
SeasonGM/A		**17.6**	**253**	**244**	**147**	**2**	**551**	**8.16**	**31.2**	**3.2**	**1.16**	**0.047**	**0.0223**	**0.769**	**0.044**	**0.337**	**0.0134**	**8.9**
Dry Max		21.0	670	660	210	4	622	8.32	42.9	3.5	1.18	0.074	0.0380	2.600	0.088	0.495	0.0240	14.1
3rd Quart		20.8	300	275	138	4	573	8.26	34.5	3.1	1.07	0.059	0.0336	0.760	0.066	0.443	0.0200	11.1
Dry Median		19.5	200	200	105	2	540	8.16	29.6	2.9	0.97	0.054	0.0275	0.680	0.057	0.300	0.0140	10.0
Dry GM/Avg		**19.3**	**243**	**232**	**110**	**3**	**538**	**8.14**	**31.0**	**2.9**	**1.02**	**0.052**	**0.0264**	**0.923**	**0.051**	**0.291**	**0.0143**	**9.3**
1st Quart		19.0	180	170	85	2	510	8.08	27.0	2.7	0.95	0.047	0.0218	0.620	0.024	0.191	0.0085	7.0
Dry Min		17.0	150	140	70	2	432	7.81	22.2	2.3	0.90	0.026	0.0070	0.420	0.018	0.045	0.0060	4.5
Wet Max		20.0	3200	3200	3400	4	596	8.31	35.1	6.7	2.34	0.062	0.0270	0.780	0.106	0.530	0.0210	11.0
3rd Quart		19.8	1945	1945	1920	3	579	8.27	33.1	5.4	1.93	0.057	0.0270	0.695	0.070	0.505	0.0185	9.5
Wet Median		19.5	690	690	440	2	562	8.22	31.0	4.0	1.52	0.051	0.0270	0.610	0.034	0.480	0.0160	7.9
Wet GM/Avg		**19.5**	**918**	**900**	**748**	**3**	**571**	**8.15**	**32.1**	**4.0**	**1.63**	**0.053**	**0.0248**	**0.657**	**0.057**	**0.422**	**0.0157**	**8.5**
1st Quart		19.3	520	510	360	3	558	8.08	30.6	2.7	1.28	0.049	0.0238	0.595	0.032	0.368	0.0130	7.3
Wet Min		19.0	350	330	280	2	554	7.93	30.2	1.3	1.03	0.046	0.0205	0.580	0.030	0.255	0.0100	6.6

APPENDIX E

Spencer Creek 1993 - STATION FE1 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		˚C	FC	EC	FS	PA	Cond	pH	Chlori	esP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
4-May-93	W	12.0	72	72	16	2	554	8.40	28.8	5.9	1.68	0.020	0.0010	0.480	0.002	0.800	0.0060	5.0
19-May-93	I	9.0	228	200	160	2	602	8.43	35.1	4.4	1.59	0.014	0.0020	0.400	0.002	0.985	0.0030	4.0
2-Jun-93	I	11.0	416	400	232	2	547	8.38	33.0	6.0	1.68	0.018	0.0055	0.500	0.002	0.645	0.0030	5.6
16-Jun-93	I		180	176	72	2	627	8.44	39.0	0.7	1.37	0.016	0.0010	0.380	0.002	0.850	0.0030	3.5
23-Jun-93	D		630	620	290	4	536	8.30	26.3	8.6	2.69	0.026	0.0010	0.700	0.002	0.215	0.0030	10.9
30-Jun-93	D	14.5	1260	1260	660	2	592	8.39	33.7	5.2	1.47	0.020	0.0015	0.500	0.002	0.685	0.0020	6.1
7-Jul-93	D		1700	1700	850	6	587	8.40	35.2	8.8	2.40	0.030	0.0020	0.500	0.002	0.710	0.0020	6.5
14-Jul-93	D	18.0	1220	1160	100	2	625	8.33	38.2	6.3	1.14	0.014	0.0010	0.460	0.006	0.685	0.0050	5.8
21-Jul-93	D	17.5	660	640	400	4	591	8.41	34.6	4.8	1.31	0.024	0.0010	1.480	0.002	0.445	0.0050	8.5
26-Jul-93	W		220000	220000	33000	240	531	8.22	32.9	27.7	9.48	0.176	0.0750	1.160	0.108	0.865	0.0120	6.8
4-Aug-93	D	15.5	640	620	230	2	626	8.45	39.1	6.5	1.33	0.056	0.0010	0.620	0.004	0.745	0.0040	5.8
11-Aug-93	W	16.0	2980	2680	1840	2	637	8.30	32.2	2.3	0.72	0.024	0.0085	0.380	0.002	1.550	0.0080	3.8
18-Aug-93	D	18.0	880	880	780	4	644	8.52	44.0	3.0	1.01		0.0010		0.002	0.845	0.0040	3.4
25-Aug-25	D	17.5	1010	940	540	2	599	7.66	45.9	4.8	0.94	0.020	0.0010	0.320	0.002	1.020	0.0050	2.8
1-Sep-93	I	17.0	2180	2040	1050	2	656	8.55	48.0	3.7	1.15	0.028	0.0110	0.400	0.004	0.800	0.0040	3.5
8-Sep-93	I	13.0	720	580	420	2	612	8.45	35.1	5.1	1.84	0.090	0.0085	0.500	0.002	0.500	0.0040	8.5
15-Sep-93	W	16.0	1700	1700	550	10	631	8.40	39.4	11.8	2.12	0.023	0.0050	0.490	0.002	0.715	0.0030	5.9
MayGM/Avg		10.5	128	120	51	2	578	8.42	32.0	5.2	1.64	0.017	0.0015	0.440	0.002	0.893	0.0045	4.5
JunGM/Avg		12.8	494	484	238	2	576	8.38	33.0	5.1	1.80	0.020	0.0023	0.520	0.002	0.599	0.0028	6.5
JulyGM/Avg		17.8	4166	4082	1029	10	584	8.34	35.2	11.9	3.58	0.061	0.0198	0.900	0.030	0.676	0.0060	6.9
AugGM/Avg		16.8	1141	1083	650	2	627	8.23	40.3	4.2	1.00	0.033	0.0029	0.440	0.003	1.040	0.0053	4.0
SepGM/Avg		15.3	1387	1262	624	3	633	8.47	40.8	6.9	1.70	0.047	0.0082	0.463	0.003	0.672	0.0037	6.0
SeasonGM/A		**15.0**	**1017**	**971**	**420**	**4**	**600**	**8.35**	**36.5**	**6.8**	**2.00**	**0.037**	**0.0075**	**0.579**	**0.009**	**0.768**	**0.0045**	**5.7**
Dry Max		18.0	1700	1700	850	6	644	8.52	45.9	8.8	2.69	0.056	0.0020	1.480	0.006	1.020	0.0050	10.9
3rd Quart		17.9	1230	1185	690	4	625	8.42	40.3	7.0	1.70	0.028	0.0011	0.660	0.003	0.770	0.0050	7.0
Dry Median		17.5	945	910	470	3	596	8.40	36.7	5.8	1.32	0.024	0.0010	0.500	0.002	0.698	0.0040	6.0
Dry GM/Avg		**16.8**	**942**	**918**	**398**	**3**	**600**	**8.31**	**37.1**	**6.0**	**1.54**	**0.027**	**0.0012**	**0.654**	**0.003**	**0.669**	**0.0038**	**6.2**
1st Quart		16.0	655	635	275	2	590	8.32	34.4	4.8	1.11	0.020	0.0010	0.480	0.002	0.625	0.0028	5.2
Dry Min		14.5	630	620	100	2	536	7.66	26.3	3.0	0.94	0.014	0.0010	0.320	0.002	0.215	0.0020	2.8
Wet Max		16.0	220000	220000	33000	240	637	8.40	39.4	27.7	9.48	0.176	0.0750	1.160	0.108	1.550	0.0120	6.8
3rd Quart		16.0	57235	57010	9630	68	633	8.40	34.5	15.8	3.96	0.062	0.0251	0.658	0.029	1.036	0.0090	6.1
Wet Median		16.0	2340	2190	1195	6	593	8.35	32.6	8.9	1.90	0.024	0.0068	0.485	0.002	0.833	0.0070	5.5
Wet GM/Avg		**14.7**	**2993**	**2915**	**855**	**10**	**588**	**8.33**	**33.3**	**11.9**	**3.50**	**0.061**	**0.0224**	**0.628**	**0.029**	**0.983**	**0.0073**	**5.4**
1st Quart		14.0	1293	1293	417	8	548	8.28	31.4	5.0	1.44	0.022	0.0040	0.455	0.082	0.779	0.0053	4.7
Wet Min		12.0	72	72	16	2	531	8.22	28.8	2.3	0.72	0.020	0.0010	0.380	0.002	0.715	0.0030	3.8

Spencer Creek 1993 - STATION FEW1 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		˚C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
30-Jun-93	D	18.0	290	290	100	2	504	8.27	10.6	3.5	0.52	0.032	0.0085	0.700	0.002	0.005	0.0040	11.4
7-Jul-93	D	27.0	1480	1460	690		657	8.39	51.9	2.2	0.61	0.008	0.0010	0.260	0.002	0.655	0.0030	4.0
14-Jul-93	D	21.0	180	180	340	2	564	7.65	11.3	6.6	1.26	0.110	0.0100	1.350	0.008	0.005	0.0040	13.8
21-Jul-93	D	22.0	100	100	80	4	549	8.09	12.5	1.3	0.39	0.034	0.0120	0.760	0.006	0.005	0.0010	14.3
26-Jul-93	W		5600	5600	8800	68	380	7.83	8.6	2.1	0.75	0.050	0.0210	0.700	0.002	0.035	0.0120	12.5
4-Aug-93	D	18.5	50	50	110	2	574	7.91	13.2	4.6	1.21	0.040	0.0135	0.480	0.002	0.005	0.0010	15.1
11-Aug-93		20.0	860	860	620	2	527	7.99	13.6	24.7	1.77	0.065	0.0120	0.950	0.002	0.005	0.0010	14.3
18-Aug-93			580	580	90	10	600	7.89	14.5	618.0	37.70	0.540	0.0220	3.850	0.068	0.025	0.0060	16.0
JunGM/Avg		18.0	290	290	100	2	504	8.27	10.6	3.5	0.52	0.032	0.0085	0.700	0.002	0.005	0.0040	11.4
JulyGM/Avg		23.3	621	619	637	8	538	7.99	21.1	3.1	0.75	0.051	0.0110	0.768	0.005	0.175	0.0050	11.2
AugGM/Avg		19.3	292	292	183	3	567	7.93	13.8	215.8	13.56	0.215	0.0158	1.760	0.024	0.012	0.0027	15.1
SepGM/Avg																		
SeasonGM/A		**21.1**	**426**	**425**	**317**	**5**	**544**	**8.00**	**17.0**	**82.9**	**5.53**	**0.110**	**0.0125**	**1.131**	**0.012**	**0.093**	**0.0040**	**12.7**
Dry Max		27.0	1480	1460	690	10	657	8.39	51.9	618.0	37.70	0.540	0.0220	3.850	0.068	0.655	0.0060	16.0
3rd Quart		22.0	508	508	283	4	594	8.23	14.2	6.1	1.25	0.093	0.0131	1.203	0.008	0.020	0.0040	14.9
Dry Median		21.0	235	235	105	2	569	8.00	12.9	4.1	0.91	0.037	0.0110	0.730	0.004	0.005	0.0035	14.1
Dry GM/Avg		**21.3**	**246**	**246**	**163**	**3**	**575**	**8.03**	**19.0**	**106.0**	**6.95**	**0.127**	**0.0112**	**1.233**	**0.015**	**0.117**	**0.0032**	**12.4**
1st Quart		18.5	120	120	93	2	553	7.90	11.6	2.5	0.54	0.033	0.0089	0.535	0.002	0.005	0.0015	12.0
Dry Min		18.0	50	50	80	2	504	7.65	10.6	1.3	0.39	0.008	0.0010	0.260	0.002	0.005	0.0010	4.0
Wet Max		20.0	5600	5600	8800	68	527	7.99	13.6	24.7	1.77	0.065	0.0210	0.950	0.002	0.035	0.0120	14.3
3rd Quart		20.0	4415	4415	6755	52	490	7.95	12.4	19.1	1.52	0.061	0.0188	0.888	0.002	0.028	0.0093	13.9
Wet Median		20.0	3230	3230	4710	35	454	7.91	11.1	13.4	1.26	0.058	0.0165	0.825	0.002	0.020	0.0065	13.4
Wet GM/Avg		**20.0**	**2195**	**2195**	**2336**	**12**	**454**	**7.91**	**11.1**	**13.4**	**1.26**	**0.058**	**0.0165**	**0.825**	**0.002**	**0.020**	**0.0065**	**13.4**
1st Quart		20.0	2045	2045	2665	19	417	7.87	9.9	7.8	1.01	0.054	0.0143	0.763	0.002	0.013	0.0038	13.0
Wet Min		20.0	860	860	620	2	380	7.83	8.6	2.1	0.75	0.050	0.0120	0.700	0.002	0.005	0.0010	12.5

APPENDIX E

Spencer Creek 1993 - STATION FEE1 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
30-Jun-93	D	15.0	300	300	190	2	663	8.33	51.6	1.6	0.31	0.006	0.0010	0.320	0.004	0.895	0.0010	3.4
7-Jul-93	D	24.0	80	80	190	2	529	7.98	11.0	8.6	1.08	0.066	0.0188	0.840	0.002	0.005	0.0020	14.3
14-Jul-93	D	19.0	270	270	170	2	677	8.34	54.9	1.4	0.38	0.004	0.0010	0.320	0.010	0.680	0.0030	3.4
21-Jul-93	D	18.0	370	370	180	4	645	8.40	51.3	2.0	0.65	0.008	0.0010	0.900	0.004	0.570	0.0030	4.9
26-Jul-93	W		10100	10000	12500	8	472	8.14	36.5	35.7	12.20	0.048	0.0010	1.040	0.008	0.615	0.0060	7.8
4-Aug-93	D	17.0	130	130	140	2	677	8.41	57.1	2.5	0.61	0.040	0.0010	0.500	0.004	0.620	0.0020	3.7
11-Aug-93	W	18.0	610	610	1230	2	669	8.44	57.1	3.2	0.94	0.008	0.0010	0.320	0.002	0.715	0.0030	3.3
18-Aug-93	D	20.0	500	500	360	4	692	8.50	59.4	3.2	1.07	0.014	0.0010	0.300	0.002	0.630	0.0010	2.8
25-Aug-25	D	18.5	550	550	380	2	330	7.72	60.1	2.2	0.72	0.008	0.0010	0.240	0.002	0.680	0.0030	2.7
1-Sep-93	I	17.0	460	440	180	2	696	8.54	60.2	2.1	0.68	0.006	0.0010	0.260	0.002	0.530	0.0030	3.2
8-Sep-93	I	11.5	130	90	190	2	667	8.44	53.2	1.1	0.65	0.002	0.0010	0.320	0.006	0.640	0.0040	5.0
15-Sep-93	W	16.0	340	340	200	4	681	8.36	56.8	2.0	0.56	0.020	0.0010	0.440	0.002	0.585	0.0030	3.8
JunGM/Avg		15.0	300	300	190	2	663	8.33	51.6	1.6	0.31	0.006	0.0010	0.320	0.004	0.895	0.0010	3.4
JulyGM/Avg		20.3	533	532	519	3	581	8.22	38.4	11.9	3.58	0.032	0.0055	0.775	0.006	0.468	0.0035	7.6
AugGM/Avg		18.4	384	384	392	2	592	8.27	58.4	2.8	0.84	0.018	0.0010	0.340	0.003	0.661	0.0023	3.1
SepGM/Avg		14.8	273	238	190	3	681	8.45	56.7	1.7	0.63	0.009	0.0010	0.340	0.003	0.585	0.0033	4.0
SeasonGM/A		17.6	385	372	338	3	617	8.30	50.8	5.5	1.65	0.019	0.0025	0.483	0.004	0.597	0.0028	4.9
Dry Max		24.0	550	550	380	4	692	8.50	60.1	8.6	1.08	0.066	0.0188	0.900	0.010	0.895	0.0030	14.3
3rd Quart		19.5	435	435	275	3	677	8.41	58.3	2.9	0.90	0.027	0.0010	0.670	0.004	0.680	0.0030	4.3
Dry Median		18.5	300	300	190	2	663	8.34	54.9	2.2	0.65	0.008	0.0010	0.320	0.004	0.630	0.0020	3.4
Dry GM/Avg		**18.8**	**262**	**262**	**215**	**2**	**602**	**8.24**	**49.3**	**3.1**	**0.69**	**0.021**	**0.0035**	**0.489**	**0.004**	**0.583**	**0.0021**	**5.0**
1st Quart		17.5	200	200	175	2	587	8.16	51.5	1.8	0.50	0.007	0.0010	0.310	0.002	0.595	0.0015	3.1
Dry Min		15.0	80	80	140	2	330	7.72	11.0	1.4	0.31	0.004	0.0010	0.240	0.002	0.005	0.0010	2.7
Wet Max		18.0	10100	10000	12500	8	681	8.44	57.1	35.7	12.20	0.048	0.0010	1.040	0.008	0.715	0.0060	7.8
3rd Quart		17.5	5355	5305	6865	6	675	8.40	57.0	19.5	6.57	0.034	0.0010	0.740	0.005	0.665	0.0045	5.8
Wet Median		17.0	610	610	1230	4	669	8.36	56.8	3.2	0.94	0.020	0.0010	0.440	0.002	0.615	0.0030	3.8
Wet GM/Avg		**17.0**	**1280**	**1275**	**1454**	**4**	**607**	**8.31**	**50.1**	**13.6**	**4.57**	**0.025**	**0.0010**	**0.600**	**0.004**	**0.638**	**0.0040**	**5.0**
1st Quart		16.5	475	475	715	3	571	8.25	46.7	2.6	0.75	0.014	0.0010	0.380	0.005	0.600	0.0045	3.6
Wet Min		16.0	340	340	200	2	472	8.14	36.5	2.0	0.56	0.008	0.0010	0.320	0.002	0.585	0.0030	3.3

Spencer Creek 1993 - STATION FEE2 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL, CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
11-Aug-93	W	15.0	620	620	230	2	640	8.30	32.5	2.3	0.75	0.032	0.0030	0.540	0.002	0.850	0.0050	3.5
25-Aug-25	D	15.0	730	720	220	2	553	7.69	35.2	2.4	0.93	0.022	0.0105	0.320	0.002	1.830	0.0060	2.3
1-Sep-93	I	18.0	780	780	530	2	666	8.41	36.7	2.9	0.72	0.028	0.0150	0.380	0.008	1.610	0.0060	2.9
8-Sep-93	I	11.5	400	400	310	2	644	8.44	29.9	4.6	0.74		0.0140		0.018	1.260	0.0070	5.5
15-Sep-93	W	15.0	350	350	190	2	656	8.19	31.3	10.0	1.01	0.022	0.0135	0.470	0.004	1.340	0.0060	4.4
AugGM/Avg		15.0	673	668	225	2	597	8.00	33.9	2.4	0.84	0.027	0.0068	0.430	0.002	1.340	0.0055	2.9
SepGM/Avg		14.8	478	478	315	2	655	8.35	32.6	5.8	0.82	0.025	0.0142	0.425	0.010	1.403	0.0063	4.3
SeasonGM/A		14.9	548	546	275	2	632	8.21	33.1	4.4	0.83	0.026	0.0112	0.428	0.007	1.378	0.0060	3.7
Dry Max		15.0	730	720	220	2	553	7.69	35.2	2.4	0.93	0.022	0.0105	0.320	0.002	1.830	0.0060	2.3
3rd Quart		15.0	730	720	220	2	553	7.69	35.2	2.4	0.93	0.022	0.0105	0.320	0.002	1.830	0.0060	2.3
Dry Median		15.0	730	720	220	2	553	7.69	35.2	2.4	0.93	0.022	0.0105	0.320	0.002	1.830	0.0060	2.3
Dry GM/Avg		**15.0**	**730**	**720**	**220**	**2**	**553**	**7.69**	**35.2**	**2.4**	**0.93**	**0.022**	**0.0105**	**0.320**	**0.002**	**1.830**	**0.0060**	**2.3**
1st Quart		15.0	730	720	220	2	553	7.69	35.2	2.4	0.93	0.022	0.0105	0.320	0.002	1.830	0.0060	2.3
Dry Min		15.0	730	720	220	2	553	7.69	35.2	2.4	0.93	0.022	0.0105	0.320	0.002	1.830	0.0060	2.3
Wet Max		15.0	620	620	230	2	656	8.30	32.5	10.0	1.01	0.032	0.0135	0.540	0.004	1.340	0.0060	4.4
3rd Quart		15.0	553	553	220	2	652	8.27	32.2	8.1	0.95	0.030	0.0109	0.523	0.004	1.218	0.0058	4.2
Wet Median		15.0	485	485	210	2	648	8.25	31.9	6.2	0.88	0.027	0.0083	0.505	0.003	1.095	0.0055	4.0
Wet GM/Avg		**15.0**	**466**	**466**	**209**	**2**	**648**	**8.25**	**31.9**	**6.2**	**0.88**	**0.027**	**0.0083**	**0.505**	**0.003**	**1.095**	**0.0055**	**4.0**
1st Quart		15.0	418	418	200	2	644	8.22	31.6	4.2	0.82	0.025	0.0056	0.488	0.003	0.973	0.0053	3.7
Wet Min		15.0	350	350	190	2	640	8.19	31.3	2.3	0.75	0.022	0.0030	0.470	0.002	0.850	0.0050	3.5

APPENDIX E

Spencer Creek 1993 - STATION SP7 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
19-May-93	I	13.5	76	76	20	2	377	8.34	11.0	3.0	1.80	0.026	0.0015	0.580	0.048	0.050	0.0060	4.9
2-Jun-93	I	15.0	16	16	27	2	318	8.65	10.4	1.5	0.96	0.024	0.0015	0.580	0.016	0.010	0.0020	5.2
16-Jun-93	I		152	152	124	2	328	8.64	10.7	1.7	1.40	0.018	0.0010	0.540	0.020	0.005	0.0040	5.3
23-Jun-93	D		70	70	100	4	332	8.45	10.7	1.7	1.49	0.030	0.0010	0.640	0.054	0.005	0.0030	5.7
30-Jun-93	D	23.5	110	100	30	2	333	8.36	10.6	2.1	0.72	0.018	0.0010	0.560	0.042	0.015	0.0020	5.4
7-Jul-93	D	28.5	240	210	380	2	328	8.61	108.0	15.7	5.08	0.056	0.0015	0.820	0.022	0.035	0.0040	6.2
14-Jul-93	D	27.0	60	60	50	2	330	8.39	10.8	3.0	1.76	0.026	0.0010	0.640	0.056	0.045	0.0060	5.7
21-Jul-93	D	25.0	30	30	30	4	326	8.55	11.1	2.9	2.21	0.030	0.0010	0.620	0.020	0.020	0.0040	5.9
26-Jul-93	W		310	310	520	4	332	8.41	11.2	2.9	1.83	0.030	0.0020	0.680	0.030	0.025	0.0050	6.2
4-Aug-93	D	22.0	8	8	110	2	325	8.52	11.3	2.3	1.64	0.040	0.0010	0.520	0.030	0.035	0.0060	6.1
11-Aug-93	W	23.0	50	50	230	2	329	8.44	11.5	2.4	1.30	0.034	0.0025	0.620	0.008	0.075	0.0070	6.0
18-Aug-93	D	25.0	10	10	60	4	334	8.36	11.9	2.4	1.70	0.052	0.0010	0.720	0.008	0.125	0.0040	6.2
25-Aug-25	D	25.0	10	10	650	2	364	7.86	12.5	3.6	1.43	0.050	0.0015	0.780	0.032	0.150	0.0040	6.1
1-Sep-93	I	24.5	20	20	80	2	338	8.45	12.4		1.75	0.026	0.0010	0.700	0.024	0.085	0.0040	6.3
8-Sep-93	I	21.5	10	10	50	2	340	8.39	12.3	3.8	2.60	0.026	0.0010	0.660	0.020	0.015	0.0050	6.3
15-Sep-93	W	19.0	10	10	20	2	342	8.35	13.5	3.0	2.49	0.024	0.0010	0.660	0.026	0.020	0.0030	6.2
MayGM/Avg		13.5	76	76	20	2	377	8.34	11.0	3.0	1.80	0.026	0.0015	0.580	0.048	0.050	0.0060	4.9
JunGM/Avg		19.3	66	64	56	2	328	8.53	10.6	1.8	1.14	0.023	0.0011	0.580	0.033	0.009	0.0028	5.4
JulyGM/Avg		26.8	108	104	131	3	329	8.49	35.3	6.1	2.72	0.036	0.0014	0.690	0.032	0.031	0.0048	6.0
AugGM/Avg		23.8	14	14	177	2	338	8.30	11.8	2.7	1.52	0.044	0.0015	0.660	0.020	0.096	0.0053	6.1
SepGM/Avg		21.7	13	13	43	2	340	8.40	12.7	3.4	2.28	0.025	0.0010	0.673	0.023	0.040	0.0040	6.3
SeasonGM/A		**22.5**	**37**	**37**	**83**	**2**	**336**	**8.42**	**17.5**	**3.5**	**1.89**	**0.032**	**0.0013**	**0.645**	**0.029**	**0.045**	**0.0043**	**5.9**
Dry Max		28.5	240	210	650	4	364	8.61	108.0	15.7	5.08	0.056	0.0015	0.820	0.056	0.150	0.0060	6.2
3rd Quart		26.0	80	78	178	4	333	8.53	12.1	3.2	1.87	0.051	0.0011	0.735	0.045	0.065	0.0045	6.1
Dry Median		25.0	45	45	80	2	331	8.42	11.2	2.7	1.67	0.035	0.0010	0.640	0.031	0.035	0.0040	6.0
Dry GM/Avg		**25.1**	**36**	**35**	**96**	**3**	**334**	**8.39**	**23.4**	**4.2**	**2.00**	**0.038**	**0.0011**	**0.663**	**0.033**	**0.054**	**0.0041**	**5.9**
1st Quart		24.3	10	10	45	2	328	8.36	10.8	2.3	1.48	0.029	0.0010	0.605	0.022	0.019	0.0038	5.7
Dry Min		22.0	8	8	30	2	325	7.86	10.6	1.7	0.72	0.018	0.0010	0.520	0.008	0.005	0.0020	5.4
Wet Max		23.0	310	310	520	4	342	8.44	13.5	3.0	2.49	0.034	0.0025	0.680	0.030	0.075	0.0070	6.2
3rd Quart		22.0	180	180	375	3	337	8.43	12.5	3.0	2.16	0.032	0.0023	0.670	0.028	0.050	0.0060	6.2
Wet Median		21.0	50	50	230	2	332	8.41	11.5	2.9	1.83	0.030	0.0020	0.660	0.026	0.025	0.0050	6.2
Wet GM/Avg		**21.0**	**54**	**54**	**134**	**3**	**334**	**8.40**	**12.1**	**2.8**	**1.87**	**0.029**	**0.0018**	**0.653**	**0.021**	**0.040**	**0.0050**	**6.1**
1st Quart		20.0	30	30	125	3	331	8.38	11.4	2.7	1.57	0.027	0.0015	0.640	0.017	0.023	0.0040	6.1
Wet Min		19.0	10	10	20	2	329	8.35	11.2	2.4	1.30	0.024	0.0010	0.620	0.008	0.020	0.0030	6.0

Spencer Creek 1993 - STATION VR Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
2-Jun-93	I	15.0	4	4	4	2	320	8.52	10.3	2.1	1.02	0.022	0.0015	0.580	0.026	0.010	0.0030	5.2
16-Jun-93	I		28	16	28	2	344	8.10	20.1	19.2	10.20	0.058	0.0025	0.900	0.012	0.010	0.0020	6.0
23-Jun-93	D		10	10	10	4	335	8.41	10.4	2.8	1.85	0.036	0.0015	0.660	0.030	0.005	0.0020	5.7
30-Jun-93	D	23.0	10	10	40	2	326	8.34	10.1	2.2	0.88	0.022	0.0010	0.600	0.038	0.005	0.0010	5.7
7-Jul-93	D	30.0	320	160	560	6	306	8.75	10.3	5.3	3.10	0.022	0.0015	0.560	0.008	0.015	0.0010	6.0
14-Jul-93	D	26.5	10	10	20	2	310	8.70	10.5	2.4	1.55	0.020	0.0010	0.620	0.026	0.020	0.0040	5.9
21-Jul-93	D	25.0	10	10	10	4	304	8.71	10.2	2.0	1.71	0.026	0.0010	1.120	0.016	0.005	0.0030	6.2
26-Jul-93	W		230	230	230	4	310	8.41	10.5	2.6	2.05	0.026	0.0010	0.640	0.014	0.025	0.0030	6.1
4-Aug-93	D	22.0	8	8	10	2	316	8.60	11.1	1.4	1.65	0.036	0.0010	1.040	0.030	0.005	0.0020	6.2
11-Aug-93	W	23.0	70	70	80	2	319	8.52	11.2	2.4	1.60	0.030	0.0010	0.700	0.022	0.005	0.0020	6.1
18-Aug-93	D	26.0	100	80	60	4	307	8.64	11.4	4.1	3.23	0.036	0.0010	0.740	0.030	0.005	0.0010	6.3
25-Aug-25	D	25.0	10	10	20	2	383	7.97	11.9	3.3	2.72	0.030	0.0035	0.800	0.110	0.010	0.0020	6.4
1-Sep-93	I	24.0	20	20	80	2	339	8.37	11.9	2.8	2.32	0.030	0.0015	0.800	0.032	0.015	0.0030	6.6
8-Sep-93	I	20.5	10	10	10	2	337	8.39	12.1	3.6	2.72	0.024	0.0010	0.720	0.008	0.005	0.0030	6.5
15-Sep-93	W	19.0	30	30	10	2	340	8.31	13.0	2.5	2.16	0.023	0.0010	0.650	0.012	0.005	0.0020	6.3
JunGM/Avg		19.0	10	9	15	2	331	8.34	12.7	6.6	3.49	0.035	0.0016	0.685	0.027	0.008	0.0020	5.7
JulyGM/Avg		27.2	52	44	71	4	308	8.64	10.4	3.1	2.10	0.024	0.0011	0.735	0.016	0.016	0.0028	6.1
AugGM/Avg		24.0	27	26	31	2	331	8.43	11.4	2.8	2.30	0.033	0.0016	0.820	0.048	0.006	0.0018	6.3
SepGM/Avg		21.2	18	18	20	2	339	8.36	12.3	3.0	2.40	0.026	0.0012	0.723	0.017	0.008	0.0027	6.5
SeasonGM/A		**23.3**	**23**	**21**	**29**	**3**	**326**	**8.45**	**11.7**	**3.9**	**2.58**	**0.029**	**0.0014**	**0.742**	**0.028**	**0.010**	**0.0023**	**6.1**
Dry Max		30.0	320	160	560	6	383	8.75	11.9	5.3	3.23	0.036	0.0035	1.120	0.110	0.020	0.0040	6.4
3rd Quart		26.3	33	28	45	4	328	8.70	11.2	3.5	2.82	0.036	0.0015	0.860	0.032	0.011	0.0023	6.2
Dry Median		25.0	10	10	20	3	313	8.62	10.5	2.6	1.78	0.028	0.0010	0.700	0.030	0.005	0.0020	6.1
Dry GM/Avg		**25.4**	**20**	**18**	**29**	**3**	**323**	**8.52**	**10.7**	**2.9**	**2.09**	**0.029**	**0.0014**	**0.768**	**0.036**	**0.009**	**0.0020**	**6.1**
1st Quart		24.0	10	10	10	2	307	8.39	10.3	2.2	1.63	0.022	0.0010	0.615	0.024	0.005	0.0010	5.9
Dry Min		22.0	8	8	10	2	304	7.97	10.1	1.4	0.88	0.020	0.0010	0.560	0.008	0.005	0.0010	5.7
Wet Max		23.0	230	230	230	4	340	8.52	13.0	2.6	2.16	0.030	0.0010	0.700	0.022	0.025	0.0030	6.3
3rd Quart		22.0	150	150	155	3	330	8.47	12.1	2.6	2.11	0.028	0.0010	0.675	0.018	0.015	0.0025	6.2
Wet Median		21.0	70	70	80	2	319	8.41	11.2	2.5	2.05	0.026	0.0010	0.650	0.014	0.005	0.0020	6.1
Wet GM/Avg		**21.0**	**78**	**78**	**57**	**3**	**323**	**8.41**	**11.6**	**2.5**	**1.94**	**0.026**	**0.0010**	**0.663**	**0.016**	**0.012**	**0.0023**	**6.2**
1st Quart		20.0	50	50	45	3	315	8.36	10.9	2.5	1.83	0.025	0.0010	0.645	0.013	0.015	0.0025	6.2
Wet Min		19.0	30	30	10	2	310	8.31	10.5	2.4	1.60	0.023	0.0010	0.640	0.012	0.005	0.0020	6.1

APPENDIX E

Spencer Creek 1993 - STATION V1 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
4-May-93	W	15.0	20	20	64	2	548	8.18	11.8	1.7	0.76	0.056	0.0320	0.620	0.004	0.030	0.0090	7.1
19-May-93	I	11.0	512	504	136	2	544	8.21	8.9	2.3	1.74	0.074	0.0450	0.400	0.004	0.025	0.0030	5.2
2-Jun-93	I	13.0	224	224	57	2	516	8.18	9.8	1.6	1.03	0.068	0.0405	0.520	0.002	0.020	0.0040	6.0
16-Jun-93	I		580	580	60	2	551	8.13	7.7	3.9	2.89	0.130	0.0795	0.580	0.034	0.060	0.0070	6.0
23-Jun-93	D		740	740	180	4	555	8.24	15.0	3.0	1.05	0.110	0.0765	0.760	0.006	0.045	0.0060	10.1
30-Jun-93	D	17.0	440	430	320	2	574	8.10	11.8	3.0	1.91	0.122	0.0815	0.640	0.008	0.080	0.0070	7.2
7-Jul-93	D	25.0	630	610	370	2	574	8.13	10.2	3.0	2.62	0.148	0.0020	0.680	0.054	0.170	0.0210	8.1
14-Jul-93	D	20.0	230	230	450	2	552	7.98	12.3	3.0	2.67	0.156	0.1220	0.600	0.044	0.150	0.0230	7.2
21-Jul-93	D		360	360	250	4	537	8.22	11.5	3.0	2.74	0.164	0.1340	0.620	0.014	0.120	0.0110	7.1
26-Jul-93	W		42000	41000	37000	160	426	7.86	11.3	10.2	3.58	0.230	0.1120	1.120	0.054	0.240	0.0570	10.9
4-Aug-93	D	18.0	180	180	280	2	534	8.15	11.1	7.5	2.72		0.1300		0.004	0.130	0.0030	6.9
11-Aug-93	W	18.0	2100	2100	6100	4	501	8.18	10.6	4.7	3.25	0.172	0.2100	0.660	0.002	0.070	0.0040	7.4
18-Aug-93	D	20.0	180	180	240	4	497	8.27	9.4	12.5	3.05	0.215	0.1580	0.600	0.002	0.110	0.0020	6.1
25-Aug-25	D	20.0	140	140	530	2	318	7.80	9.6	31.5	5.51	0.270	0.1420	0.600	0.016	0.130	0.0070	5.8
1-Sep-93	I	18.5	320	320	450	2	508	8.25	10.7	22.8	8.91	0.410	0.1800	1.050	0.046	0.160	0.0100	6.2
8-Sep-93	I	12.5	220	220	230	2	594	8.25	16.4	2.2	1.48	0.098	0.0860	0.620	0.022	0.035	0.0050	8.8
15-Sep-93	W	17.0	300	300	410	2	571	8.31	16.3	3.4	2.20	0.147	0.1200	0.640	0.010	0.060	0.0050	8.9
MayGM/Avg		13.0	101	100	93	2	546	8.20	10.4	2.0	1.25	0.065	0.0385	0.510	0.004	0.028	0.0060	6.2
JunGM/Avg		15.0	454	451	118	2	549	8.16	11.1	2.9	1.72	0.108	0.0695	0.625	0.013	0.051	0.0060	7.3
JulyGM/Avg		22.5	1217	1200	1114	7	522	8.05	11.3	4.8	2.90	0.175	0.0925	0.755	0.042	0.170	0.0280	8.3
AugGM/Avg		19.0	312	312	683	3	463	8.10	10.2	14.1	3.63	0.219	0.1600	0.620	0.006	0.110	0.0040	6.6
SepGM/Avg		16.0	276	276	349	2	558	8.27	14.5	9.5	4.20	0.218	0.1287	0.770	0.026	0.085	0.0067	8.0
SeasonGM/A		**17.3**	**402**	**400**	**357**	**3**	**524**	**8.14**	**11.4**	**7.0**	**2.83**	**0.161**	**0.1030**	**0.669**	**0.019**	**0.096**	**0.0108**	**7.4**
Dry Max		25.0	740	740	530	4	574	8.27	15.0	31.5	5.51	0.270	0.1580	0.760	0.054	0.170	0.0230	10.1
3rd Quart		20.0	488	475	390	4	560	8.23	11.9	8.8	2.82	0.190	0.1360	0.660	0.023	0.135	0.0135	7.4
Dry Median		20.0	295	295	300	2	545	8.14	11.3	3.0	2.70	0.156	0.1260	0.620	0.011	0.125	0.0070	7.2
Dry GM/Avg		**20.0**	**306**	**304**	**310**	**3**	**518**	**8.11**	**11.4**	**8.3**	**2.78**	**0.169**	**0.1058**	**0.643**	**0.019**	**0.117**	**0.0100**	**7.3**
1st Quart		18.5	180	180	248	2	525	8.07	10.1	3.0	2.44	0.135	0.0803	0.600	0.006	0.103	0.0053	6.7
Dry Min		17.0	140	140	180	2	318	7.80	9.4	3.0	1.05	0.110	0.0020	0.600	0.002	0.045	0.0020	5.8
Wet Max		18.0	42000	41000	37000	160	571	8.31	16.3	10.2	3.58	0.230	0.2100	1.120	0.054	0.240	0.0570	10.9
3rd Quart		17.5	12075	11825	13825	43	554	8.21	12.9	6.1	3.33	0.187	0.1425	0.775	0.021	0.113	0.0210	9.4
Wet Median		17.0	1200	1200	3255	3	525	8.18	11.6	4.1	2.73	0.160	0.1160	0.650	0.007	0.065	0.0070	8.2
Wet GM/Avg		**16.7**	**853**	**848**	**1560**	**7**	**512**	**8.13**	**12.5**	**5.0**	**2.45**	**0.151**	**0.1185**	**0.760**	**0.018**	**0.100**	**0.0188**	**8.6**
1st Quart		16.0	230	230	324	4	482	8.10	11.1	3.0	1.84	0.124	0.0920	0.635	0.004	0.053	0.0048	7.3
Wet Min		15.0	20	20	64	2	426	7.86	10.6	1.7	0.76	0.056	0.0320	0.620	0.002	0.030	0.0040	7.1

Spencer Creek 1993 - STATION V2 Data

			BACTERIAL DATA				NUTRIENT, PHYSICAL, CHEMICAL DATA											
DATE		°C	FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
4-May-93	W	14.5	92	92	24	2	524	8.41	8.4	1.9	0.87	0.078	0.0500	0.560	0.008	0.230	0.0150	5.7
19-May-93	I	11.0	184	168	144	2	539	8.38	8.1	1.5	0.52	0.056	0.0310	0.320	0.006	0.365	0.0070	3.1
2-Jun-93	I	13.0	53	53	80	2	505	8.34	7.5	3.4	0.69	0.050	0.0310	0.460	0.002	0.185	0.0050	4.9
16-Jun-93	I		152	152	144	2	542	8.12	7.0	4.8	0.92	0.106	0.0520	0.400	0.010	0.100	0.0050	2.9
23-Jun-93	D		100	100	200	4	539	8.10	7.7	1.3	0.74	0.108	0.0760	0.640	0.036	0.110	0.0080	8.1
30-Jun-93	D	16.5	80	80	180	2	543	8.34	7.7	2.6	1.05	0.110	0.0705	0.400	0.030	0.130	0.0070	3.3
7-Jul-93	D	24.0	90	80	270	2	550	8.02	9.5	3.6	1.16	0.174	0.0010	0.460	0.080	0.150	0.0130	3.7
14-Jul-93	D		130	130	110	2	549	8.05	8.7	5.9	1.98	0.340	0.2950	0.540	0.120	0.105	0.0150	3.9
21-Jul-93	D	20.0	60	60	110	4	540	8.27	8.9	2.4	1.09	0.144	0.1330	0.560	0.028	0.120	0.0090	5.0
26-Jul-93	W		3700	3600	50000	12	449	7.86	13.8	5.1	2.22	0.198	0.1400	0.700	0.074	0.350	0.0250	6.4
4-Aug-93	D	17.5	110	110	480	2	552	8.07	8.4	2.0	0.91	0.008	0.1350	0.280	0.028	0.120	0.0110	3.3
11-Aug-93	W	17.5	900	880	1500	2	522	8.13	12.2	4.1	1.34	0.142	0.1060	0.480	0.036	0.180	0.0130	4.5
18-Aug-93	D	20.5	200	200	680	4	547	8.19	8.6	4.3					0.088	0.140	0.0230	3.3
25-Aug-25	D	20.0	410	410	330	2	360	7.93	9.0	6.8	1.87	0.170	0.1360	0.460	0.142	0.180	0.0290	3.0
1-Sep-93	I	19.0	340	340	880	2	541	8.51	8.6		1.70	0.160	0.1400	0.480	0.134	0.185	0.0230	3.1
8-Sep-93	I	13.0	150	150	180	2	569	8.24	11.7	5.0	1.59	0.112	0.0680	0.600	0.044	0.245	0.0110	7.1
15-Sep-93	W	17.0	320	320	460	2	550	8.48	9.9	6.4	1.96		0.0900		0.068	0.255	0.0180	4.9
MayGM/Avg		12.8	130	124	59	2	532	8.40	8.3	1.7	0.70	0.067	0.0405	0.440	0.007	0.298	0.0110	4.4
JunGM/Avg		14.8	90	90	143	2	532	8.23	7.5	3.0	0.85	0.094	0.0574	0.475	0.020	0.131	0.0063	4.8
JulyGM/Avg		22.0	226	218	636	4	522	8.05	10.2	4.3	1.61	0.214	0.1423	0.565	0.076	0.181	0.0155	4.8
AugGM/Avg		18.9	300	298	634	2	495	8.08	9.6	4.3	1.37	0.107	0.1257	0.407	0.074	0.155	0.0190	3.5
SepGM/Avg		16.3	254	254	418	2	553	8.41	10.1	5.7	1.75	0.136	0.0993	0.540	0.082	0.228	0.0173	5.0
SeasonGM/A		**17.2**	**186**	**183**	**314**	**3**	**525**	**8.20**	**9.2**	**3.8**	**1.29**	**0.130**	**0.0972**	**0.489**	**0.055**	**0.185**	**0.0139**	**4.5**
Dry Max		24.0	410	410	680	4	552	8.34	9.5	6.8	1.98	0.340	0.2950	0.640	0.142	0.180	0.0290	8.1
3rd Quart		20.4	148	148	368	4	549	8.21	8.9	4.7	1.52	0.172	0.1355	0.550	0.096	0.143	0.0170	4.2
Dry Median		20.0	105	105	235	2	545	8.09	8.7	3.1	1.09	0.144	0.1330	0.460	0.058	0.125	0.0120	3.5
Dry GM/Avg		**19.8**	**122**	**121**	**244**	**3**	**523**	**8.12**	**8.6**	**3.6**	**1.26**	**0.151**	**0.1209**	**0.477**	**0.069**	**0.132**	**0.0144**	**4.2**
1st Quart		18.1	88	80	163	2	540	8.04	8.2	2.3	0.98	0.109	0.0733	0.430	0.030	0.118	0.0088	3.3
Dry Min		16.5	60	60	110	2	360	7.93	7.7	1.3	0.74	0.008	0.0010	0.280	0.028	0.105	0.0070	3.0
Wet Max		17.5	3700	3600	50000	12	550	8.48	13.8	6.4	2.22	0.198	0.1400	0.700	0.074	0.350	0.0250	6.4
3rd Quart		17.3	1600	1560	13625	5	531	8.43	12.6	5.4	2.03	0.170	0.1145	0.630	0.070	0.279	0.0198	5.9
Wet Median		17.0	610	600	980	2	523	8.27	11.1	4.6	1.65	0.142	0.0980	0.560	0.052	0.243	0.0165	5.3
Wet GM/Avg		**16.3**	**560**	**553**	**954**	**3**	**511**	**8.22**	**11.1**	**4.4**	**1.60**	**0.139**	**0.0965**	**0.580**	**0.047**	**0.254**	**0.0178**	**5.4**
1st Quart		15.8	263	263	351	10	504	8.06	9.5	3.6	1.22	0.110	0.0800	0.520	0.029	0.218	0.0145	4.8
Wet Min		14.5	92	92	24	2	449	7.86	8.4	1.9	0.87	0.078	0.0500	0.480	0.008	0.180	0.0130	4.5

APPENDIX E

Spencer Creek 1993 - STATION VC Data

DATE		°C	BACTERIAL DATA				NUTRIENT, PHYSICAL , CHEMICAL DATA											
			FC	EC	FS	PA	Cond	pH	Chlori	ResP	Turbid	Pphor	Pphate	T.K.N.	Ammo	Nitrate	Nitrites	DOC
PWQN Limits			*100*	*100*					*250.0*		*50.00*	*0.030*		*0.500*		*0.500*	*0.0100*	
4-May-93	W	11.0	12	12	8	2	526	8.32	8.1	4.7	1.01	0.014	0.0010	0.360	0.004	0.720	0.0050	2.1
19-May-93	I	9.0	12	12	4	2	544	8.34	7.7	2.9	0.59	0.006	0.0010	0.200	0.002	0.865	0.0010	1.7
2-Jun-93	I	10.0	10	10	24	2	509	8.33	7.5	3.0	0.75	0.008	0.0015	0.200	0.002	0.850	0.0010	2.0
16-Jun-93	I		8	8	44	2	552	8.36	7.8	7.4	3.75	0.040	0.0010	0.580	0.002	0.940	0.0010	1.2
23-Jun-93	D		60	60	27	4	532	8.34	7.4	7.0	1.63	0.022	0.0010	0.420	0.002	0.830	0.0020	2.9
30-Jun-93	D	11.0	50	50	50	2	551	8.31	7.6	4.5	1.04	0.010	0.0010	0.220	0.004	0.985	0.0020	1.5
7-Jul-93	D	24.0	60	60	120	2	552	8.34	7.9	7.2	2.20	0.014	0.0015	0.280	0.002	0.875	0.0010	2.2
14-Jul-93	D	12.0	70	70	170	2	556	8.26	7.8	5.6	1.15	0.002	0.0010	0.240	0.020	1.010	0.0030	1.4
21-Jul-93	D	14.0	90	90	60	4	546	8.41	7.8	7.3	1.79	0.012	0.0025	0.280	0.002	0.955	0.0020	1.7
26-Jul-93	W		3100	3100	10700	12	348	7.94	6.9	15.8	3.59	0.052	0.0080	0.920	0.002	0.140	0.0100	12.8
4-Aug-93	D	11.0	48	48	84	2	551	8.37	7.8	5.5	1.39		0.0010		0.002	0.990	0.0010	1.4
11-Aug-93	W	14.0	2100	1900	5800	2	499	8.28	8.7	10.0	2.69	0.030	0.0020	0.620	0.002	0.450	0.0030	6.3
18-Aug-93	D	14.0	80	80	240	4	543	8.45	7.8	4.0	1.54		0.0015		0.002	0.920	0.0010	1.4
25-Aug-25	D	13.0	80	80	110	2	361	7.98	7.8	4.6	1.53	0.008	0.0010	0.200	0.002	1.000	0.0030	1.4
1-Sep-93	I	13.0	50	40	150	2	554	8.49	7.8	13.4	2.74	0.014	0.0040	0.300	0.002	0.990	0.0020	1.2
8-Sep-93	I	11.5	20	20	40	2	553	8.40	7.6	7.2	1.92	0.014	0.0025	0.380	0.004	0.845	0.0030	2.6
15-Sep-93	W	12.5	110	110	60	2	545	8.54	7.9	7.9		0.012	0.0010	0.230	0.002	0.860	0.0020	2.1
MayGM/Avg		10.0	12	12	6	2	535	8.33	7.9	3.8	0.80	0.010	0.0010	0.280	0.003	0.793	0.0030	1.9
JunGM/Avg		10.5	22	22	35	2	536	8.34	7.6	5.5	1.79	0.020	0.0011	0.355	0.003	0.901	0.0015	1.9
JulyGM/Avg		16.7	185	185	338	4	501	8.24	7.6	9.0	2.18	0.020	0.0033	0.430	0.007	0.745	0.0040	4.5
AugGM/Avg		13.0	159	155	337	2	489	8.27	8.0	6.0	1.79	0.019	0.0014	0.410	0.002	0.840	0.0020	2.6
SepGM/Avg		12.3	48	44	71	2	551	8.48	7.8	9.5	2.33	0.013	0.0025	0.303	0.003	0.898	0.0023	2.0
SeasonGM/A		**12.9**	**62**	**61**	**93**	**3**	**519**	**8.32**	**7.8**	**6.9**	**1.83**	**0.017**	**0.0019**	**0.362**	**0.003**	**0.837**	**0.0025**	**2.7**
Dry Max		24.0	90	90	240	4	556	8.45	7.9	7.3	2.20	0.022	0.0025	0.420	0.020	1.010	0.0030	2.9
3rd Quart		14.0	80	80	133	4	551	8.38	7.8	7.1	1.67	0.014	0.0015	0.280	0.003	0.993	0.0023	1.8
Dry Median		13.0	65	65	97	2	549	8.34	7.8	5.6	1.54	0.011	0.0010	0.260	0.003	0.970	0.0020	1.5
Dry GM/Avg		**14.1**	**66**	**66**	**88**	**3**	524	**8.31**	7.7	5.7	**1.53**	**0.011**	**0.0013**	**0.273**	**0.005**	**0.946**	**0.0019**	**1.7**
1st Quart		11.5	58	58	58	2	540	8.30	7.8	4.6	1.33	0.009	0.0010	0.225	0.002	0.909	0.0010	1.4
Dry Min		11.0	48	48	27	2	361	7.98	7.4	4.0	1.04	0.002	0.0010	0.200	0.002	0.830	0.0010	1.4
Wet Max		14.0	3100	3100	10700	12	545	8.54	8.7	15.8	3.59	0.052	0.0080	0.920	0.004	0.860	0.0100	12.8
3rd Quart		13.3	2350	2200	7025	5	531	8.38	8.3	11.5	3.14	0.036	0.0035	0.695	0.003	0.755	0.0063	7.9
Wet Median		12.5	1105	1005	2930	2	513	8.30	8.0	9.0	2.69	0.022	0.0015	0.490	0.002	0.585	0.0040	4.2
Wet GM/Avg		**12.5**	**304**	**297**	**415**	**3**	**480**	**8.27**	**7.9**	**9.6**	**2.43**	**0.027**	**0.0030**	**0.533**	**0.003**	**0.543**	**0.0050**	**5.8**
1st Quart		11.8	86	86	47	10	461	8.20	7.7	7.1	1.85	0.014	0.0018	0.328	0.004	0.373	0.0028	5.3
Wet Min		11.0	12	12	8	2	348	7.94	6.9	4.7	1.01	0.012	0.0010	0.230	0.002	0.140	0.0020	2.1

APPENDIX F

Water Quality Results for each Parameter in Spencer Creek Watershed

APPENDIX F

Spencer Creek 1993 - FECAL COLIFORM Data

DATE		SAMPLING STATIONS																						
		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	12	92	20						72		60		116		44				40	84	44	32	
19-May-93	I	12	184	512		76				228	36	72		44		96				92	160	276	60	
2-Jun-93	I	10	53	224	4	16				416	84	164		220		348				680	312	188	428	16
16-Jun-93	I	8	152	580	28	152				180	136	112		276		408				1480	268	148	388	216
23-Jun-93	D	60	100	740	10	70				630	200	170		1400		1450				1500	910	550	1900	240
30-Jun-93	D	50	80	440	10	110		300	290	1260	270	40		1160	770	1010	50	2200	32000	6000	470	730	580	230
7-Jul-93	D	60	90	630	320	240		80	1480	1700	660	350		2340	880	800	940			3700	330	210	590	50
14-Jul-93	D	70	130	230	10	60		270	180	1220	200	120		1660	930	1680		3500	145000	6200	940		860	
21-Jul-93	D	90	60	360	10	30		370	100	660	470	150		1920	1440	1300	500			6600	940	520	680	100
26-Jul-93	W	3100	3700	42000	230	310		10100	5600	220000	3200	1400		9000	26000	6200	140	7000		260000	3600		5200	
4-Aug-93	D	48	110	180	8	8		130	50	640	390	140		1160	680	960	520			2500	460	120	500	40
11-Aug-93	W	2100	900	2100	70	50	620	610	860	2980	690	110	9700	8900	3700	1120	1950			7400	760	680	630	
18-Aug-93	D	80	200	180	100	10		500	580	880	190	20	6700	1200	1400	580		1640		4300	420	300	280	20
25-Aug-93	D	80	410	140	10	10	730	550		1010	150	10	4000	3900	860	680		560	1340	5500	220		110	
1-Sap-93	I	50	340	320	50	20	780	460		2180	320	50	5500	1700	670	500		630	620	3800	380	130	400	10
8-Sep-93	I	20	150	220	10	10	400	130		720	230	80	3600	2800	300	590		1100	1110	910	1020	640	760	
15-Sap-93	W	110	320	300	30	10	350	340		1700	350	240	11800	2600	570	1050		760	1340	1840	620	1260	600	
MayGM		12	130	101		76				128	36	66		71		65				61	116	110	44	
JunGM		22	90	454	10	66		300	290	494	158	106		560	770	675	50	2200	32000	1735	435	325	654	118
JulyGM		185	226	1217	52	108		533	621	4166	668	306		2862	2353	1814	404	4950	145000	14086	1012	330	1157	71
AugGM		159	300	312	27	14	673	384	292	1141	296	42	6382	2636	1319	807	1007	958	1340	4574	424	290	314	28
SapGM		48	254	276	25	13	478	273		1387	295	99	6159	2313	486	677		808	973	1853	622	472	567	10
SeasonGM		62	186	402	25	37	548	385	426	1017	271	102	6270	1193	1192	675	387	1503	4231	2432	481	295	447	58
Dry Max		90	410	740	320	240	730	550	1480	1700	660	350	6700	3900	1440	1680	940	3500	145000	6600	940	730	1900	240
3rd Quart		80	148	488	33	80	730	435	508	1230	410	155	6025	2025	1165	1338	625	2525	88500	6050	918	543	725	198
Dry Median		65	105	295	10	45	730	300	235	945	235	130	5350	1530	880	985	510	1920	32000	4900	465	410	585	75
Dry GM		66	122	306	20	36	730	262	246	942	279	77	5177	1687	958	996	332	1631	18388	4105	519	341	526	78
1st Quart		58	88	180	10	10	730	200	120	655	198	35	4675	1190	815	770	388	1370	16670	3400	398	233	445	43
Dry Min		48	60	140	8	8	730	80	50	630	150	10	4000	1160	680	580	50	560	1340	1500	220	120	110	20
Wet Max		3100	3700	42000	230	310	620	10100	5600	220000	3200	1400	11800	9000	26000	6200	1950	7000	1340	260000	3600	1260	5200	
3rd Quart		2350	1600	12075	150	180	553	5355	4415	57235	1945	530	11275	8925	14850	2390	1498	5440	1340	70550	1470	970	1773	
Wet Madian		1105	610	1200	70	50	485	610	3230	2340	690	175	10750	5750	3700	1085	1045	3880	1340	4620	690	680	615	
Wat GM		304	560	853	78	54	466	1280	2195	2993	918	217	10699	2217	3799	753	522	2307	1340	3450	614	335	501	
1st Quart		86	263	230	50	30	418	475	2045	1293	520	98	10225	1979	2135	799	593	2320	1340	1390	486	362	456	
Wet Min		12	92	20	30	10	350	340	860	72	350	60	9700	116	570	44	140	760	1340	40	84	44	32	

Spencer Creek 1993 - E. COLI Data

DATE		SAMPLING STATIONS																						
		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	12	92	20						72		60		116		44				40	84	44	32	
19-May-93	I	12	168	504		76				200	36	72		44		96				92	156	268	60	
2-Jun-93	I	10	53	224	4	16				400	80	164		216		348				680	304	188	412	12
16-Jun-93	I	8	152	580	16	152				176	136	108		268		408				1460	268	144	380	152
23-Jun-93	D	60	100	740	10	70				620	200	170		1400		1430				1490	910	540	1900	140
30-Jun-93	D	50	80	430	10	100		300	290	1260	240	40		1150	770	950	50	2200	32000	6000	460	730	570	230
7-Jul-93	D	60	80	610	160	210		80	1460	1700	660	350		2320	880	800	940			3700	320	210	590	50
14-Jul-93	D	70	130	230	10	60		270	180	1160	200	120		1640	920	1680		3500	145000	6200	930		830	
21-Jul-93	D	90	60	360	10	30		370	100	640	450	140		1840	1440	1280	500			6600	920	520	680	100
26-Jul-93	W	3100	3600	41000	230	310		10000	5600	220000	3200	1400		9000	26000	6100	140	6900		260000	3500		5200	
4-Aug-93	D	48	110	180	8	8		130	50	620	380	140		1140	640	960	520			2500	460	100	500	40
11-Aug-93	W	1900	880	2100	70	50	620	610	860	2680	690	110	9600	8900	3700	1120	1950			7300	760	680	620	
18-Aug-93	D	80	200	180	80	10		500	580	800	180	20	6700	1200	1400	580		1600		4200	420	300	240	20
25-Aug-93	D	80	410	140	10	10	720	550		940	140	10	4000	3900	850	680		540	1170	5100	180		90	
1-Sap-93	I	40	340	320	50	20	780	440		2040	290	50	5300	1680	660	480		630	540	3800	370	120	300	10
8-Sep-93	I	20	150	220	10	10	400	90		580	230	80	3600	2750	300	560		1090	1090	880	980	580	700	
15-Sap-93	W	110	320	300	30	10	350	340		1700	330	240	11700	2550	550	1050		750	1340	1700	620	1220	580	
MayGM		12	124	100		76				120	36	66		71		65				61	114	109	44	
JunGM		22	90	451	9	64		300	290	484	151	105		553	770	663	50	2200	32000	1726	430	321	642	88
JulyGM		185	218	1200	44	104		532	619	4082	660	301		2817	2346	1800	404	4914	145000	14086	989	330	1147	71
AugGM		155	298	312	26	14	668	384	292	1057	285	42	6360	2625	1296	807	1007	930	1170	4447	403	273	286	28
SepGM		44	254	276	25	13	478	238		1262	280	99	6066	2275	478	656		802	924	1785	608	440	496	10
SaasonGM		61	183	400	22	37	546	372	425	966	263	101	6211	1180	1178	667	387	1485	4030	2398	469	285	424	51
Dry Max		90	410	740	160	210	720	550	1460	1700	660	350	6700	3900	1440	1680	940	3500	145000	6600	930	730	1900	230
3rd Quart		80	148	475	28	78	720	435	508	1185	398	148	6025	1960	1160	1318	625	2525	88500	6050	913	535	718	130
Dry Madian		65	105	295	10	45	720	300	235	870	220	130	5350	1520	880	955	510	1900	32000	4650	460	410	580	75
Dry GM		66	121	304	18	35	720	262	246	907	269	76	5177	1669	947	985	332	1606	17575	4051	501	330	500	71
1st Quart		58	80	180	10	10	720	200	120	635	195	35	4675	1188	810	770	388	1335	16585	3400	395	233	435	43
Ory Min		48	60	140	8	8	720	80	50	620	140	10	4000	1140	640	580	50	540	1170	1490	180	100	90	20
Wet Max		3100	3600	41000	230	310	620	10000	5600	220000	3200	1400	11700	9000	26000	6100	1950	6900	1340	260000	3500	1220	5200	
3rd Quart		2200	1560	11825	150	180	553	5305	4415	57010	1945	530	11175	8925	14850	2365	1498	5363	1340	70475	1445	950	1765	
Wet Median		1005	600	1200	70	50	485	610	3230	2190	690	175	10650	5725	3700	1085	1045	3825	1340	4500	690	680	600	
Wet GM		297	553	848	78	54	466	1275	2195	2915	900	217	10598	2206	3754	750	522	2275	1340	3371	610	332	495	
1st Quart		86	263	230	50	30	418	475	2045	1293	510	98	10125	1942	2125	799	593	2288	1340	1285	486	362	443	
Wet Min		12	92	20	30	10	350	340	860	72	330	60	9600	116	550	44	140	750	1340	40	84	44	32	

APPENDIX F

Spencer Creek 1993 - FECAL STREPTOCOCCI Data

		SAMPLING STATIONS																						
DATE		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	8	24	64						16		16		60		40				16	16	32	40	
19-May-93	I	4	144	136		20				160	28	52		40		16				16	36	100	24	
2-Jun-93	I	24	80	57	4	27				232	68	52		112		68				80	52	80	48	4
16-Jun-93	I	44	144	60	28	124				72	40	4		72		32				120	44	104	132	12
23-Jun-93	D	27	200	180	10	100				290	130	120		2400		350				200	190	360	280	20
30-Jun-93	D	50	180	320	40	30		190	100	660	210	110		320	490	280	140	350	960	380	210	640	230	90
7-Jul-93	D	120	270	370	560	380		190	690	850	160	120		420	570	200	120			370	150	270	230	10
14-Jul-93	D	170	510	450	20	50		170	340	100	90	100		510	470	290		700	3100	570	160		230	
21-Jul-93	D	60	110	250	10	30		180	80	400	150	70		330	360	550	420			800	400	440	920	40
26-Jul-93	W	10700	50000	37000	230	520		12500	8800	33000	3400	2500		25000	16000	7500	560	12100		36000	7000		5100	
4-Aug-93	D	84	480	280	10	110		140	110	230	120	90		310	560	150	40			1220	100	60	170	130
11-Aug-93	W	5800	1500	6100	80	230	230	1230	620	1840	440	550	3700	3600	3100	360	790			1900	600	760	230	
18-Aug-93	D	240	680	240	60	60		360	90	780	90	70	2380	2700	700	60		620		1900	340	160	20	320
25-Aug-93	D	110	330	530	20	650	220	380		540	70	60	3200	2100	1050	340		520	1480	1220	210		50	
1-Sep-93	I	150	880	450	20	80	530	180		1050	250	110	1380	880	270	270		190		1280	200	60	230	30
8-Sep-93	I	40	180	230	10	50	310	190		420	280	110	640	420	340	360		190	140	130	280	340	380	
15-Sep-93	W	60	460	410	10	20	190	200		550	280	60	1000	540	220	270		170	220	480	220	420	320	
MayGM		6	59	93		20				51	28	29		49		25				16	24	57	31	
JunGM		35	143	118	15	56		190	100	238	93	41		281	490	121	140	350	960	164	98	209	142	17
JulyGM		338	933	1114	71	131		519	637	1029	293	214		1153	1115	699	304	2910	3100	1570	509	345	706	20
AugGM		337	634	683	31	177	225	392	183	650	135	120	3043	1586	1063	182	178	568	1480	1522	256	194	79	204
SepGM		71	418	349	13	43	315	190		624	270	90	959	584	272	297		183	175	431	231	205	304	30
SeasonGM		93	343	357	26	83	275	338	317	420	154	86	1709	545	720	196	224	526	671	425	178	183	173	33
Dry Max		240	680	530	560	650	220	380	690	850	210	120	3200	2700	1050	550	420	700	3100	1900	400	640	920	320
3rd Quart		133	488	390	45	178	220	275	283	690	153	113	2995	2175	635	343	210	640	2290	1220	243	420	243	120
Dry Median		97	300	300	20	80	220	190	105	470	125	95	2790	465	560	285	130	570	1480	685	200	315	230	65
Dry GM		88	296	310	29	96	220	215	163	398	121	90	2760	746	570	236	130	530	1639	661	202	253	164	56
1st Quart		58	195	248	10	45	220	175	93	275	90	70	2585	328	480	188	100	478	1220	378	158	188	140	25
Dry Min		27	110	180	10	30	220	140	80	100	70	60	2380	310	360	60	40	350	960	200	100	60	20	10
Wet Max		10700	50000	37000	230	520	230	12500	8800	33000	3400	2500	3700	25000	16000	7500	790	12100	220	36000	7000	760	5100	
3rd Quart		7025	13625	13825	155	375	220	6865	6755	9630	1920	1038	3025	8950	9550	2145	733	9118	220	10425	2200	590	1515	
Wet Median		2930	980	3255	80	230	210	1230	4710	1195	440	305	2350	2070	3100	315	675	6135	220	1190	410	420	275	
Wet GM		415	954	1560	57	134	209	1454	2336	855	748	191	1924	1307	2218	413	665	1434	220	851	349	217	350	
1st Quart		47	351	324	45	125	200	715	2665	417	360	49	1675	420	1660	213	618	3153	220	364	169	226	183	
Wet Min		8	24	64	10	20	190	200	620	16	280	16	1000	60	220	40	560	170	220	16	16	32	40	

Spencer Creek 1993 - PSEUDOMONAS AERUGINOSA Data

		SAMPLING STATIONS																						
DATE		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	2	2	2						2		2		2		2				2	2	2	2	
19-May-93	I	2	2	2		2				2	2	2		2		2				2	2	2	2	
2-Jun-93	I	2	2	2	2	2				2	2	2		4		2				2	2	2	2	2
16-Jun-93	I	2	2	2	2	2				2	2	2		2		2				2	2	2	2	56
23-Jun-93	D	4	4	4	4	4				4	4	4		4		4				4	4	4	4	4
30-Jun-93	D	2	2	2	2	2		2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2
7-Jul-93	D	2	2	2	6	2		2		6	2	2		2	2	4	2			2	2	2	2	2
14-Jul-93	D	2	2	2	2	2		2	2	2	2	2		4	2	2		2	24	2	2		2	
21-Jul-93	D	4	4	4	4	4		4	4	4	4	4		4	4	4	4			4	4	4	4	4
26-Jul-93	W	12	12	160	4	4		8	68	240	4	4		8	4	4	4	4		70	4		28	
4-Aug-93	D	2	2	2	2	2		2	2	2	2	2		2	2	2	2			2	2	2	2	2
11-Aug-93	W	2	2	4	2	2	2	2	2	2	2	2	2	2	2	52	2			2	2	2	10	
18-Aug-93	D	4	4	4	4	4		4	10	4	4	4	4	10	10	4		4		4	4	4	4	4
25-Aug-93	D	2	2	2	2	2	2	2		2	2	2	2	4	2	1		2	2	2	2		2	
1-Sep-93	I	2	2	2	2	2	2	2		2	2	2	2	2	2	2		2	2	2	2	2	2	2
8-Sep-93	I	2	2	2	2	2	2	2		2	2	2	4	2	2	2		2	2	2	2	2	2	
15-Sep-93	W	2	2	2	2	2	2	4		10	2	2	4	6	2	2		2	4	2	4	4	4	
MayGM		2	2	2		2				2	2	2		2		2				2	2	2	2	
JunGM		2	2	2	2	2		2	2	2	2	2		3	2	2	2	2	2	2	2	2	2	5
JulyGM		4	4	7	4	3		3	8	10	3	3		4	3	3	3	3	24	6	3	3	5	3
AugGM		2	2	3	2	2	2	2	3	2	2	2	3	4	3	5	2	3	2	2	2	3	4	3
SepGM		2	2	2	2	2	2	3		3	2	2	3	3	2	2		2	3	2	3	3	3	2
SeasonGM		3	3	3	3	2	2	3	5	4	2	2	3	3	3	3	3	2	3	3	2	2	3	4
Dry Max		4	4	4	6	4	2	4	10	6	4	4	4	10	10	4	4	4	24	4	4	4	4	4
3rd Quart		4	4	4	4	4	2	3	4	4	4	4	4	4	3	4	3	3	13	4	4	[illegible]	4	4
Dry Median		2	2	2	3	2	2	2	2	3	2	2	3	4	2	3	2	2	2	2	2	[illegible]	2	3
Dry GM		3	3	3	3	3	2	2	3	3	3	3	3	3	3	3	2	2	5	3	3	[illegible]	3	3
1st Quart		2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	4	4	13	2	2	2	2	2
Dry Min		2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2
Wet Max		12	12	160	4	4	2	8	68	240	4	4	4	8	4	52	4	4	4	70	4	4	28	
3rd Quart		5	5	43	3	3	2	6	52	68	3	3	4	7	3	16	4	4	4	19	4	3	15	
Wet Median		2	2	3	2	2	2	4	35	6	2	2	3	4	2	3	3	3	4	36	3	2	7	
Wet GM		3	3	7	3	3	2	4	12	10	3	2	3	4	3	5	3	3	4	5	3	3	7	
1st Quart		10	10	4	3	3	2	3	19	8	3	4	3	5	3	4	3	3	4	53	4	3	4	
Wet Min		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	2	2	2	2	

Spencer Creek 1993 - CONDUCTIVITY Data

		SAMPLING STATIONS																						
DATE		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	526	524	548						554		501		507		541				668	557	591	564	
19-May-93	I	544	539	544		377				602	568	567		563		588				743	604	635	611	
2-Jun-93	I	509	505	516	320	318				547	508	507		513		537				705	558	626	575	584
16-Jun-93	I	552	542	551	344	328				627	568	549		535		564				782	581	649	581	610
23-Jun-93	D	532	539	555	335	332				536	496	482		488		516				760	539	673	570	566
30-Jun-93	D	551	543	574	326	333		663	504	592	520	511		509	644	524	604	748	783	788	531	646	543	534
7-Jul-93	D	552	550	574	306	328		529	657	587	597	562		549	644	567	620			779	858	629	569	570
14-Jul-93	D	556	549	552	310	330		677	564	625	565	539		528	641	564		727	790	780	576		572	
21-Jul-93	D	546	540	537	304	326		645	549	591	540	515		512	648	541	771			771	556	709	576	562
26-Jul-93	W	348	449	426	310	332		472	380	531	554	556		524	520	531	613	700		719	537		512	
4-Aug-93	D	551	552	534	316	325		677	574	626	559	541		535	653	533	580			757	529	629	548	528
11-Aug-93	W	499	522	501	319	329	640	669	527	637	596	567	540	554	624	561	694			752	573	566	551	
18-Aug-93	D	543	547	497	307	334		692	600	644	622	588	574	583	639	579		690		765	580	572	556	519
25-Aug-93	D	361	360	318	383	364	553	330		599	432	453	537	404	540	533		616	576	579	493		513	
1-Sep-93	I	554	541	508	339	338	666	696		656	599	567	551	551	648	566		694	757	777	590	526	601	549
8-Sep-93	I	553	569	594	337	340	644	667		612	555	550	544	540	701	554			782	804	567	881	590	
15-Sep-93	W	545	550	571	340	342	656	681		631	562	547	549	547	674	554		675	779	798	559	784	574	
MayAvg		535	532	546		377				578	568	534		535		565				706	581	613	588	
JunAvg		536	532	549	331	328		663	504	576	523	512		511	644	535	604	748	783	759	552	649	567	574
JulyAvg		501	522	522	308	329		581	538	584	564	543		528	613	551	668	714	790	762	632	669	557	566
AugAvg		489	495	463	331	338	597	592	567	627	552	537	550	519	614	552	637	653	576	713	544	589	542	524
SepAvg		551	553	558	339	340	655	681		633	572	555	548	546	674	558		685	773	793	572	730	588	549
SeasonAvg		519	525	524	326	336	632	617	544	600	553	535	549	526	631	550	647	693	745	749	576	651	565	558
Dry Max		556	552	574	383	364	553	692	657	644	622	588	574	583	653	579	771	748	790	788	858	709	576	570
3rd Quart		551	549	560	328	333	553	677	594	625	573	546	565	539	646	565	658	732	787	779	577	666	571	565
Dry Madian		549	545	545	313	331	553	663	569	596	550	527	556	520	644	537	612	709	783	768	548	638	563	548
Dry Avg		524	523	518	323	334	553	602	575	600	541	524	556	514	630	545	644	695	716	747	583	643	556	547
1st Quart		540	540	525	307	328	553	587	553	590	514	504	546	504	640	531	598	672	680	759	531	629	547	530
Dry Min		361	360	318	304	325	553	330	504	536	432	453	537	404	540	516	580	616	576	579	493	572	513	519
Wet Max		545	550	571	340	342	656	681	527	637	596	567	549	554	674	561	694	700	779	798	573	784	574	
3rd Quart		531	531	554	330	337	652	675	490	633	579	559	547	549	649	556	674	694	779	764	563	688	567	
Wet Madian		513	523	525	319	332	648	669	454	593	562	552	545	536	624	548	654	688	779	736	558	591	558	
Wet Avg		480	511	512	323	334	648	607	454	588	571	543	545	533	606	547	654	688	779	734	557	647	550	
1st Quart		461	504	482	315	331	644	571	417	548	558	536	542	520	572	539	633	681	779	706	552	579	541	
Wet Min		348	449	426	310	329	640	472	380	531	554	501	540	507	520	531	613	675	779	668	537	566	512	

Spencer Creek 1993 - pH Data

		SAMPLING STATIONS																						
DATE		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	8.32	8.41	8.18						8.40		8.23		8.39		8.31				8.33	8.39	8.35	8.30	
19-May-93	I	8.34	8.38	8.21		8.34				8.43	8.18	8.31		8.40		8.39				8.24	8.42	8.35	8.37	
2-Jun-93	I	8.33	8.34	8.18	8.52	8.65				8.38	8.16	8.35		8.38		8.41				8.23	8.42	8.33	8.33	8.45
16-Jun-93	I	8.36	8.12	8.13	8.10	8.64				8.44	8.26	8.34		8.43		8.39				8.33	8.48	8.53	8.36	8.27
23-Jun-93	D	8.34	8.10	8.24	8.41	8.45				8.30	8.06	8.27		8.30		8.27				8.26	8.36	8.32	8.32	8.43
30-Jun-93	D	8.31	8.34	8.10	8.34	8.36		8.33	8.27	8.39	8.28	8.25		8.33	8.16	8.31	8.15	8.14	8.28	8.29	8.40	8.22	8.38	8.37
7-Jul-93	D	8.34	8.02	8.13	8.75	8.61		7.98	8.39	8.40	8.16	8.25		8.34	8.26	8.42	8.08			8.28	8.57	8.35	8.57	8.44
14-Jul-93	D	8.26	8.05	7.99	8.70	8.39		8.34	7.65	8.33	8.16	8.05		8.28	8.13	8.31		8.01	7.75	8.36	8.38		8.27	
21-Jul-93	D	8.41	8.27	8.22	8.71	8.55		8.40	8.09	8.41	8.20	8.32		8.39	8.28	8.45	8.30			8.30	8.63	8.25	8.35	8.29
26-Jul-93	W	7.94	7.86	7.86	8.41	8.41		8.14	7.83	8.22	7.93	7.99		8.23	8.04	8.16	8.11	7.97		8.03	8.18		8.25	
4-Aug-93	D	8.37	8.07	8.15	8.60	8.52		8.41	7.91	8.45	8.08	8.24		8.37	8.28	8.54	8.36			8.27	8.75	8.16	8.36	8.40
11-Aug-93	W	8.28	8.13	8.18	8.52	8.44	8.30	8.44	7.99	8.30	8.22	8.25	8.46	8.42	8.33	8.49	8.22			8.31	8.52	8.42	8.61	
18-Aug-93	D	8.45	8.19	8.27	8.64	8.36		8.50	7.89	8.52	8.25	8.23	8.46	8.40	8.33	8.42		8.23		8.30	8.54	8.48	8.70	8.27
25-Aug-93	D	7.98	7.93	7.80	7.97	7.86	7.69	7.72		7.66	7.81	7.83	7.88	7.90	7.72	7.82		7.76	8.02	7.50	8.06		7.98	
1-Sep-93	I	8.49	8.51	8.25	8.37	8.45	8.41	8.54		8.55	8.28	8.31	8.53	8.53	8.49	8.53		8.34	8.41	8.38	8.57	8.71	8.55	8.53
8-Sep-93	I	8.40	8.24	8.25	8.39	8.39	8.44	8.44		8.45	8.15	8.15	8.41	8.42	8.34	8.32			8.19	8.30	8.41	8.15	8.35	
15-Sep-93	W	8.54	8.48	8.31	8.31	8.35	8.19	8.36		8.40	8.31	8.47	8.34	8.39	8.34	8.38		8.34	8.31	8.15	8.38	8.19	8.26	
MayAvg		8.33	8.40	8.20		8.34				8.42	8.18	8.27		8.40		8.35				8.29	8.41	8.35	8.34	
JunAvg		8.34	8.23	8.16	8.34	8.53		8.33	8.27	8.38	8.19	8.30		8.36	8.16	8.35	8.15	8.14	8.28	8.28	8.42	8.35	8.35	8.38
JulyAvg		8.24	8.05	8.05	8.64	8.49		8.22	7.99	8.34	8.11	8.15		8.31	8.18	8.34	8.16	7.99	7.75	8.24	8.44	8.30	8.36	8.37
AugAvg		8.27	8.08	8.10	8.43	8.30	8.00	8.27	7.93	8.23	8.09	8.14	8.27	8.27	8.17	8.32	8.29	8.00	8.02	8.10	8.47	8.35	8.41	8.34
SepAvg		8.48	8.41	8.27	8.36	8.40	8.35	8.45		8.47	8.25	8.31	8.43	8.45	8.39	8.41		8.34	8.30	8.28	8.45	8.35	8.39	8.53
SeasonAvg		8.32	8.20	8.14	8.45	8.42	8.21	8.30	8.00	8.35	8.16	8.23	8.35	8.35	8.23	8.35	8.20	8.11	8.16	8.23	8.44	8.34	8.37	8.38
Dry Max		8.45	8.34	8.27	8.75	8.61	7.69	8.50	8.39	8.52	8.28	8.32	8.46	8.40	8.33	8.54	8.36	8.23	8.28	8.36	8.75	8.48	8.70	8.44
3rd Quart		8.38	8.21	8.23	8.70	8.53	7.69	8.41	8.23	8.42	8.21	8.26	8.32	8.38	8.28	8.43	8.32	8.16	8.15	8.30	8.59	8.34	8.43	8.42
Dry Median		8.34	8.09	8.14	8.62	8.42	7.69	8.34	8.00	8.40	8.16	8.25	8.17	8.34	8.26	8.37	8.23	8.08	8.02	8.29	8.47	8.29	8.36	8.39
Dry Avg		8.31	8.12	8.11	8.52	8.39	7.69	8.24	8.03	8.31	8.13	8.18	8.17	8.29	8.17	8.32	8.22	8.04	8.02	8.20	8.46	8.30	8.37	8.37
1st Quart		8.30	8.04	8.07	8.39	8.36	7.69	8.16	7.90	8.32	8.08	8.19	8.03	8.30	8.15	8.30	8.13	7.95	7.89	8.27	8.38	8.23	8.31	8.31
Dry Min		7.98	7.93	7.80	7.97	7.86	7.69	7.72	7.65	7.66	7.81	7.83	7.88	7.90	7.72	7.82	8.08	7.76	7.75	7.50	8.06	8.16	7.98	8.27
Wet Max		8.54	8.48	8.31	8.52	8.44	8.30	8.44	7.99	8.40	8.31	8.47	8.46	8.42	8.34	8.49	8.22	8.34	8.31	8.33	8.52	8.42	8.61	
3rd Quart		8.38	8.43	8.21	8.47	8.43	8.27	8.40	7.95	8.40	8.27	8.31	8.43	8.40	8.34	8.41	8.19	8.25	8.31	8.32	8.42	8.39	8.38	
Wet Madian		8.30	8.27	8.18	8.41	8.41	8.25	8.36	7.91	8.35	8.22	8.24	8.40	8.39	8.33	8.35	8.17	8.16	8.31	8.23	8.39	8.35	8.28	
Wet Avg		8.27	8.22	8.13	8.41	8.40	8.25	8.31	7.91	8.33	8.15	8.24	8.40	8.36	8.24	8.34	8.17	8.16	8.31	8.21	8.37	8.32	8.36	
1st Quart		8.20	8.06	8.10	8.36	8.38	8.22	8.25	7.87	8.28	8.08	8.17	8.37	8.35	8.19	8.27	8.14	8.06	8.31	8.12	8.33	8.27	8.26	
Wet Min		7.94	7.86	7.86	8.31	8.35	8.19	8.14	7.83	8.22	7.93	7.99	8.34	8.23	8.04	8.16	8.11	7.97	8.31	8.03	8.18	8.19	8.25	

APPENDIX F

Spencer Creek 1993 - CHLORIDE Data

		SAMPLING STATIONS																						
DATE		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	8.1	8.4	11.8						28.8		24.7		25.4		29.0				39.8	30.8	32.0	32.3	
19-May-93	I	7.7	8.1	8.9		11.0				35.1	29.4	30.2		30.0		32.2				46.0	33.4	34.1	34.4	
2-Jun-93	I	7.5	7.5	9.8	10.3	10.4				33.0	27.6	28.3		29.0		31.9				50.4	34.5	41.6	36.9	43.4
16-Jun-93	I	7.8	7.0	7.7	20.1	10.7				39.0	30.2	29.9		28.9		30.6				49.5	33.0	44.7	33.4	54.8
23-Jun-93	D	7.4	7.7	15.0	10.4	10.7				26.3	22.2	22.0		22.7		26.4				50.8	29.3	43.0	33.4	42.9
30-Jun-93	D	7.6	7.7	11.8	10.1	10.6		51.6	10.6	33.7	24.8	24.0		23.8	43.1	25.3	36.9	34.9	45.2	50.5	26.5	39.1	28.0	28.2
7-Jul-93	D	7.9	9.5	10.2	10.3	10.8		11.0	51.9	35.2	33.2	31.5		29.8	45.0	32.3	43.3			49.5	34.1	47.4	35.3	33.0
14-Jul-93	D	7.8	8.7	12.3	10.5	10.8		54.9	11.3	38.2	30.0	29.3		29.7	46.3	33.3		30.4	44.3	51.3	34.7		35.4	
21-Jul-93	D	7.8	8.9	11.5	10.2	11.1		51.3	12.5	34.6	28.4	27.7		27.8	44.4	31.4	74.8			47.5	33.0	53.9	34.6	37.9
26-Jul-93	W	6.9	13.8	11.3	10.5	11.2		36.5	8.6	32.9	31.0	33.3		29.3	35.9	29.8	48.6	26.9		44.5	30.2		35.2	
4-Aug-93	D	7.8	8.4	11.1	11.1	11.3		57.1	13.2	39.1	29.1	28.2		27.6	48.4	29.0	37.5			50.2	29.7	63.5	30.8	35.7
11-Aug-93	W	8.7	12.2	10.6	11.2	11.5	32.5	57.1	13.6	32.2	35.1	33.3	31.2	31.7	47.7	33.1	25.8			47.6	34.6	37.0	34.6	
18-Aug-93	D	7.8	8.6	9.4	11.4	11.9		59.4	14.5	44.0	38.4	36.9	35.3	35.2	50.6	35.9		24.3		48.9	37.1	37.3	37.2	40.2
25-Aug-93	D	7.8	9.0	9.6	11.9	12.5	35.2	60.1		45.9	42.9	41.4	39.5	39.4	51.7	40.0		23.8	44.5	48.2	41.8		41.7	
1-Sep-93	I	7.8	8.6	10.7	11.9	12.4	36.7	60.2		48.0	38.0	35.2	36.3	35.8	52.3	39.0		23.3	47.6	51.9	41.7	44.4	44.7	45.3
8-Sep-93	I	7.6	11.7	16.4	12.1	12.3	29.9	53.2		35.1	28.7	28.4	28.3	28.3	44.7	29.6			41.6	47.9	31.1	56.3	34.2	
15-Sep-93	W	7.9	9.9	16.3	13.0	13.5	31.3	56.8		39.4	30.2	29.6	29.2	29.2	49.2	30.2		22.6	45.0	51.3	31.2	66.7	33.1	
MayAvg		7.9	8.3	10.4		11.0				32.0	29.4	27.5		27.7		30.6				42.9	32.1	33.1	33.4	
JunAvg		7.6	7.5	11.1	12.7	10.6		51.6	10.6	33.0	26.2	26.1		26.1	43.1	28.6	36.9	34.9	45.2	50.3	30.8	42.1	32.9	42.3
JulyAvg		7.6	10.2	11.3	10.4	11.0		38.4	21.1	35.2	30.7	30.5		29.2	42.9	31.7	55.6	28.7	44.3	48.2	33.0	50.7	35.1	35.5
AugAvg		8.0	9.6	10.2	11.4	11.8	33.9	58.4	13.8	40.3	36.4	35.0	35.3	33.5	49.6	34.5	31.7	24.1	44.5	48.7	35.8	45.9	36.1	38.0
SepAvg		7.8	10.1	14.5	12.3	12.7	32.6	56.7		40.8	32.3	31.1	31.3	31.1	48.7	32.9		23.0	44.7	50.4	34.7	55.8	37.3	45.3
SeasonAvg		7.8	9.2	11.4	11.7	11.4	33.1	50.8	17.0	36.5	31.2	30.2	33.3	29.6	46.6	31.7	44.5	26.6	44.7	48.6	33.3	45.8	35.0	40.2
Dry Max		7.9	9.5	15.0	11.9	12.5	35.2	60.1	51.9	45.9	42.9	41.4	39.5	39.4	51.7	40.0	74.8	34.9	45.2	51.3	41.8	63.5	41.7	42.9
3rd Quart		7.8	8.9	11.9	11.2	11.5	35.2	58.3	14.2	40.3	34.5	32.9	38.5	31.2	49.5	34.0	51.2	31.5	44.9	50.6	35.3	52.3	35.9	39.6
Dry Median		7.8	8.7	11.3	10.5	11.0	35.2	54.9	12.9	36.7	29.6	28.8	37.4	28.8	46.3	31.9	40.4	27.4	44.5	49.9	33.6	45.2	35.0	36.8
Ory Avg		7.7	8.6	11.4	10.7	11.2	35.2	49.3	19.0	37.1	31.1	30.1	37.4	29.5	47.1	31.7	48.1	28.4	44.7	49.6	33.3	47.4	34.6	36.3
1st Quart		7.8	8.2	10.1	10.3	10.8	35.2	51.5	11.6	34.4	27.5	26.8	36.4	26.7	44.7	28.4	37.4	24.2	44.4	48.7	29.6	40.1	32.8	33.7
Ory Min		7.4	7.7	9.4	10.1	10.6	35.2	11.0	10.6	26.3	22.2	22.0	35.3	22.7	43.1	25.3	36.9	23.8	44.3	47.5	26.5	37.3	28.0	28.2
Wet Max		8.7	13.8	16.3	13.0	13.5	32.5	57.1	13.6	39.4	35.1	33.3	31.2	31.7	49.2	33.1	48.6	26.9	45.0	51.3	34.6	66.7	35.2	
3rd Quart		8.3	12.6	12.9	12.1	12.5	32.2	57.0	12.4	34.5	33.1	33.3	30.7	29.9	48.5	30.9	42.9	25.8	45.0	48.5	32.1	51.9	34.8	
Wet Madian		8.0	11.1	11.6	11.2	11.5	31.9	56.8	11.1	32.6	31.0	31.5	30.2	29.3	47.7	30.0	37.2	24.8	45.0	46.1	31.0	37.0	33.9	
Wet Avg		7.9	11.1	12.5	11.6	12.1	31.9	50.1	11.1	33.3	32.1	30.2	30.2	28.9	44.3	30.5	37.2	24.8	45.0	45.8	31.7	45.2	33.8	
1st Quart		7.7	9.5	11.1	10.9	11.4	31.6	46.7	9.9	31.4	30.6	28.4	29.7	28.3	41.8	29.6	31.5	23.7	45.0	43.3	30.7	34.5	32.9	
Wet Min		6.9	8.4	10.6	10.5	11.2	31.3	36.5	8.6	28.8	30.2	24.7	29.2	25.4	35.9	29.0	25.8	22.6	45.0	39.8	30.2	32.0	32.3	

Spencer Creek 1993 - RESIDUE PARTICULATE Data

		SAMPLING STATIONS																						
DATE		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	4.7	1.9	1.7						5.9		3.9		4.5		4.6				3.8	3.5	11.1	6.8	
19-May-93	I	2.9	1.5	2.3		3.0				4.4	2.8	3.0		3.1		4.3				2.7	2.6	9.0	3.7	
2-Jun-93	I	3.0	3.4	1.6	2.1	1.5				6.0	2.0	1.8		4.7		7.8				5.6	7.0	5.6	4.9	8.5
16-Jun-93	I	7.4	4.8	3.9	19.2	1.7				0.7	2.2	3.7		3.5		6.4				9.1	3.7	5.9	4.9	5.4
23-Jun-93	D	7.0	1.3	3.0	2.8	1.7				8.6	3.0	3.9		13.4		9.5				5.3	9.2	9.2	12.7	11.8
30-Jun-93	D	4.5	2.6	3.0	2.2	2.1		1.6	3.5	5.2	2.3	2.2		5.1	4.3	5.6	7.2	4.4	51.9	10.3	3.9	9.0	11.1	17.9
7-Jul-93	D	7.2	3.6	3.0	5.3	15.7		8.6	2.2	8.8	2.8	6.6		5.6	3.5	9.0	13.1			3.4	1.4	2.9	14.8	6.1
14-Jul-93	D	5.6	5.9	3.0	2.4	3.0		1.4	6.6	6.3	2.7	3.5		5.1	4.7	11.3		10.1	59.6	6.9	4.2		22.0	
21-Jul-93	D	7.3	2.4	3.0	2.0	2.9		2.0	1.3	4.8	2.8	3.5		7.7	4.6	9.1	25.7			10.4	8.8	8.0	12.8	16.4
26-Jul-93	W	15.8	5.1	10.2	2.6	2.9		35.7	2.1	27.7	6.7	2.6		21.9	48.9	17.8	18.9	13.3		52.3	15.0		16.1	
4-Aug-93	D	5.5	2.0	7.5	1.4	2.3		2.5	4.6	6.5	3.2	3.2		5.3	5.3	7.4	21.3			11.6	11.6	11.9	12.7	10.4
11-Aug-93	W	10.0	4.1	4.7	2.4	2.4	2.3	3.2	24.7	2.3	4.0	2.3	4.9		7.3		6.9			16.3	7.0	6.4	10.0	
18-Aug-93	D	4.0	4.3	12.5	4.1	2.4		3.2	618.0	3.0	2.7	2.6	4.3	5.2	17.2	6.4		7.0		11.3	6.2	4.1	4.7	56.9
25-Aug-93	D	4.6	6.8	31.5	3.3	3.6	2.4	2.2		4.8	2.8	2.0	2.8	4.8	3.1	8.9		4.3	33.9	7.7	3.9		4.5	
1-Sep-93	I	13.4		22.8	2.8		2.9	2.1		3.7	8.0	2.9	2.2		3.6	13.9		3.7	6.2	16.6	5.2	7.9	7.5	9.3
8-Sep-93	I	7.2	5.0	2.2	3.6	3.8	4.6	1.1		5.1	1.8	3.7	6.2	5.8	7.8	6.2			3.2	3.8	5.8	29.5	10.5	
15-Sep-93	W	7.9	6.4	3.4	2.5	3.0	10.0	2.0		11.8	1.3	1.7	4.4	4.1	4.9	4.4		4.2	3.3	4.2	3.6	16.6	10.3	
MayAvg		3.8	1.7	2.0		3.0				5.2	2.8	3.5		3.8		4.5				3.3	3.1	10.1	5.3	
JunAvg		5.5	3.0	2.9	6.6	1.8		1.6	3.5	5.1	2.4	2.9		6.7	4.3	7.3	7.2	4.4	51.9	7.6	6.0	7.4	8.4	10.9
JulyAvg		9.0	4.3	4.8	3.1	6.1		11.9	3.1	11.9	3.8	4.1		10.1	15.4	11.8	19.2	11.7	59.6	18.2	7.4	5.4	16.4	11.3
AugAvg		6.0	4.3	14.1	2.8	2.7	2.4	2.8	215.8	4.2	3.2	2.5	4.0	5.1	8.2	7.6	14.1	5.7	33.9	11.7	7.2	7.5	8.0	33.7
SepAvg		9.5	5.7	9.5	3.0	3.4	5.8	1.7		6.9	3.7	2.8	4.3	5.0	5.4	8.2		4.0	4.2	8.2	4.9	18.0	9.4	9.3
SeasonAvg		6.9	3.8	7.0	3.9	3.5	4.4	5.5	82.9	6.8	3.2	3.1	4.1	6.7	9.6	8.3	15.5	6.7	26.4	10.7	6.0	9.8	10.0	15.9
Dry Max		7.3	6.8	31.5	5.3	15.7	2.4	8.6	618.0	8.8	3.2	6.6	4.3	13.4	17.2	11.3	25.7	10.1	59.6	11.6	11.6	11.9	22.0	56.9
3rd Quart		7.1	4.7	8.8	3.5	3.2	2.4	2.9	6.1	7.0	2.9	3.6	3.9	6.1	5.0	9.2	22.4	7.8	55.8	10.6	8.9	9.2	13.3	17.5
Ory Median		5.6	3.1	3.0	2.6	2.7	2.4	2.2	4.1	5.8	2.8	3.4	3.6	5.3	4.6	9.0	17.2	5.7	51.9	9.0	5.2	8.5	12.7	14.1
Ory Avg		5.7	3.6	8.3	2.9	4.2	2.4	3.1	106.0	6.0	2.8	3.4	3.6	6.5	6.1	8.4	16.8	6.5	48.5	8.4	6.2	7.5	11.9	19.9
1st Quart		4.6	2.3	3.0	2.2	2.3	2.4	1.8	2.5	4.8	2.7	2.5	3.2	5.1	3.9	7.2	11.6	4.4	42.9	6.5	3.9	5.1	9.5	10.8
Dry Min		4.0	1.3	3.0	1.4	1.7	2.4	1.4	1.3	3.0	2.3	2.0	2.8	4.8	3.1	5.6	7.2	4.3	33.9	3.4	1.4	2.9	4.5	6.1
Wet Max		15.8	6.4	10.2	2.6	3.0	10.0	35.7	24.7	27.7	6.7	3.9	4.9	21.9	48.9	17.8	18.9	13.3	3.3	52.3	15.0	16.6	16.1	
3rd Quart		11.5	5.4	6.1	2.6	3.0	8.1	19.5	19.1	15.8	5.4	2.9	4.8	13.2	28.1	11.2	15.9	11.0	3.3	25.3	9.0	13.9	11.8	
Wet Median		9.0	4.6	4.1	2.5	2.9	6.2	3.2	13.4	8.9	4.0	2.5	4.7	4.5	7.3	4.6	12.9	8.8	3.3	10.3	5.3	11.1	10.2	
Wet Avg		9.6	4.4	5.0	2.5	2.8	6.2	13.6	13.4	11.9	4.0	2.6	4.7	10.2	20.4	8.9	12.9	8.8	3.3	19.2	7.3	11.4	10.8	
1st Quart		7.1	3.6	3.0	2.5	2.7	4.2	2.6	7.8	5.0	2.7	2.2	4.5	4.3	6.1	4.5	9.9	6.5	3.3	4.1	3.6	8.8	9.2	
Wet Min		4.7	1.9	1.7	2.4	2.4	2.3	2.0	2.1	2.3	1.3	1.7	4.4	4.1	4.9	4.4	6.9	4.2	3.3	3.8	3.5	6.4	6.8	

APPENDIX F

Spencer Creek 1993 - TURBIDITY Data

		SAMPLING STATIONS																						
DATE		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	1.01	0.87	0.76						1.68		1.92		1.59		1.68				1.56	1.16	6.06	2.73	
19-May-93	I	0.59	0.52	1.74		1.80				1.59	1.50	1.44		1.76		1.76				1.63	1.32	3.56	2.01	
2-Jun-93	I	0.75	0.69	1.03	1.02	0.96				1.68	0.85	0.94		2.20		2.60				2.99	1.66	2.68	2.34	2.62
16-Jun-93	I	3.75	0.92	2.89	10.20	1.40				1.37	0.82	1.88		1.26		2.54				4.71	1.86	4.91	2.55	3.79
23-Jun-93	D	1.63	0.74	1.05	1.85	1.49				2.69	0.95	1.51		3.66		3.49				2.30	2.98	5.30	5.05	6.23
30-Jun-93	D	1.04	1.05	1.91	0.88	0.72		0.31	0.52	1.47	0.90	0.66		1.61	2.04	2.60	5.56	2.22	10.50	5.24	1.79	3.68	6.53	7.95
7-Jul-93	D	2.20	1.16	2.62	3.10	5.08		1.08	0.61	2.40	1.03	1.59		2.25	2.22	2.86	13.10			3.37	1.44	2.85	14.80	3.49
14-Jul-93	D	1.15	1.98	2.67	1.55	1.76		0.38	1.26	1.14	0.96	1.33		1.66	2.15	4.00		4.46	39.70	2.71	1.25		10.10	
21-Jul-93	D	1.79	1.09	2.74	1.71	2.21		0.65	0.39	1.31	0.98	1.17		2.67	2.26	3.71	14.10			5.58	4.20	6.83	9.05	12.60
26-Jul-93	W	3.59	2.22	3.58	2.05	1.83		12.20	0.75	9.48	2.34	1.24		7.36	26.30	7.97	11.00	5.95		28.50	7.07		11.20	
4-Aug-93	D	1.39	0.91	2.72	1.65	1.64		0.61	1.21	1.33	0.95	1.14		1.75	2.18	2.48	12.10			2.79	4.75	9.50	8.10	6.74
11-Aug-93	W	2.69	1.34	3.25	1.60	1.30	0.75	0.94	1.77	0.72	1.52	0.87	0.94	1.38	3.20	2.20	2.12			6.93	2.41	3.43	5.83	
18-Aug-93	D	1.54		3.05	3.23	1.70		1.07	37.70	1.01	1.18	1.07	1.78	2.88	9.45	3.73					3.22		4.46	31.20
25-Aug-93	D	1.53	1.87	5.51	2.72	1.43	0.93	0.72		0.94	0.98	0.71	1.02	1.79	1.44	3.49		1.26	3.80	4.51	1.55		2.07	
1-Sep-93	I	2.74	1.70	8.91	2.32	1.75	0.72	0.68		1.15	1.46	1.23	0.78	1.07	1.96	3.29		1.29	2.04	8.43	1.05	5.62	4.14	7.08
8-Sep-93	I	1.92	1.59	1.48	2.72	2.60	0.74	0.65		1.84	0.91	1.75	2.08	2.34	3.11	2.85			2.07	2.19	2.79	10.30	6.37	
15-Sep-93	W		1.96	2.20	2.16	2.49	1.01	0.56		2.12	1.03	1.63	2.62		2.08	2.73		3.66	3.08	3.05	1.99	19.00	11.30	
MayAvg		0.80	0.70	1.25		1.80				1.64	1.50	1.68		1.68		1.72				1.60	1.24	4.81	2.37	
JunAvg		1.79	0.85	1.72	3.49	1.14		0.31	0.52	1.80	0.88	1.25		2.18	2.04	2.81	5.56	2.22	10.50	3.81	2.07	4.14	4.12	5.15
JulyAvg		2.18	1.61	2.90	2.10	2.72		3.58	0.75	3.58	1.33	1.33		3.49	8.23	4.64	12.73	5.21	39.70	10.04	3.49	4.84	11.29	8.05
AugAvg		1.79	1.37	3.63	2.30	1.52	0.84	0.84	13.56	1.00	1.16	0.95	1.25	1.95	4.07	2.98	7.11	1.26	3.80	4.74	2.98	6.47	5.12	18.97
SepAvg		2.33	1.75	4.20	2.40	2.28	0.82	0.63		1.70	1.13	1.54	1.83	1.71	2.38	2.96		2.48	2.40	4.56	1.94	11.64	7.27	7.08
SeasonAvg		1.83	1.29	2.83	2.58	1.89	0.83	1.65	5.53	2.00	1.15	1.30	1.54	2.33	4.87	3.18	9.66	3.14	10.20	5.41	2.50	6.44	6.39	9.08
Dry Max		2.20	1.98	5.51	3.23	5.08	0.93	1.08	37.70	2.69	1.18	1.59	1.78	3.66	9.45	4.00	14.10	4.46	39.70	5.58	4.75	9.50	14.80	31.20
3rd Quart		1.67	1.52	2.82	2.82	1.87	0.93	0.90	1.25	1.70	0.99	1.38	1.59	2.72	2.24	3.72	13.35	3.34	25.10	4.88	3.47	6.83	9.31	11.44
Dry Median		1.54	1.09	2.70	1.78	1.67	0.93	0.65	0.91	1.32	0.97	1.16	1.40	2.02	2.18	3.49	12.60	2.22	10.50	3.37	2.39	5.30	7.32	7.35
Dry Avg		1.53	1.26	2.78	2.09	2.00	0.93	0.69	6.95	1.54	0.99	1.15	1.40	2.28	3.11	3.30	11.22	2.65	18.00	3.79	2.65	5.63	7.52	11.37
1st Quart		1.33	0.98	2.44	1.63	1.48	0.93	0.50	0.54	1.11	0.95	0.98	1.21	1.73	2.10	2.80	10.47	1.74	7.15	2.75	1.52	3.68	4.90	6.36
Dry Min		1.04	0.74	1.05	0.88	0.72	0.93	0.31	0.39	0.94	0.90	0.66	1.02	1.61	1.44	2.48	5.56	1.26	3.80	2.30	1.25	2.85	2.07	3.49
Wet Max		3.59	2.22	3.58	2.16	2.49	1.01	12.20	1.77	9.48	2.34	1.92	2.62	7.36	26.30	7.97	11.00	5.95	3.08	28.50	7.07	19.00	11.30	
3rd Quart		3.14	2.03	3.33	2.11	2.16	0.95	6.57	1.52	3.96	1.93	1.70	2.20	4.48	14.75	4.04	8.78	5.38	3.08	12.32	3.58	12.53	11.23	
Wet Median		2.69	1.65	2.73	2.05	1.83	0.88	0.94	1.26	1.90	1.52	1.44	1.78	1.59	3.20	2.47	6.56	4.81	3.08	4.99	2.20	6.06	8.52	
Wet Avg		2.43	1.60	2.45	1.94	1.87	0.88	4.57	1.26	3.50	1.63	1.42	1.78	3.44	10.53	3.65	6.56	4.81	3.08	10.01	3.16	9.50	7.77	
1st Quart		1.85	1.22	1.84	1.83	1.57	0.82	0.75	1.01	1.44	1.28	1.15	1.36	1.49	2.64	2.07	4.34	4.23	3.08	2.68	1.78	4.75	5.06	
Wet Min		1.01	0.87	0.76	1.60	1.30	0.75	0.56	0.75	0.72	1.03	0.87	0.94	1.38	2.08	1.68	2.12	3.66	3.08	1.56	1.16	3.43	2.73	

Spencer Creek 1993 - TOTAL PHOSPHORUS Data

		SAMPLING STATIONS																						
DATE		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	0.014	0.078	0.056						0.020		0.020		0.022		0.022				0.020	0.020	0.030	0.280	
19-May-93	I	0.006	0.056	0.074		0.026				0.014	0.022	0.022		0.016		0.024				0.024	0.018	0.028	0.020	
2-Jun-93	I	0.008	0.050	0.068	0.022	0.024				0.018	0.020	0.012		0.018		0.028				0.030	0.024	0.028	0.026	0.028
16-Jun-93	I	0.040	0.106	0.130	0.058	0.018				0.016	0.030	0.024		0.028		0.030				0.028	0.026	0.042	0.030	0.038
23-Jun-93	D	0.022	0.108	0.110	0.036	0.030				0.026	0.054	0.028		0.044		0.050				0.034	0.042	0.058	0.052	0.044
30-Jun-93	D	0.010	0.110	0.122	0.022	0.018		0.006	0.032	0.020	0.042	0.030		0.028	0.036	0.036	0.042	0.026	0.068	0.032	0.028	0.058	0.044	0.050
7-Jul-93	D	0.014	0.174	0.148	0.022	0.056		0.066	0.008	0.030	0.062	0.042		0.032	0.036	0.036	0.096			0.032	0.026	0.076	0.048	0.052
14-Jul-93	D	0.002	0.340	0.156	0.020	0.026		0.004	0.110	0.014	0.056	0.032		0.030	0.026	0.048		0.048	0.175	0.030	0.020		0.058	
21-Jul-93	D	0.012	0.144	0.164	0.026	0.030		0.008	0.034	0.024	0.064	0.026		0.028	0.046	0.038	0.210			0.038	0.030	0.058	0.038	0.058
26-Jul-93	W	0.052	0.198	0.230	0.026	0.030		0.048	0.050	0.176	0.062	0.036		0.070	0.152	0.050	0.162	0.050		0.215	0.050		0.056	
4-Aug-93	D		0.008		0.036	0.040		0.040	0.040	0.056		0.050		0.106	0.040	0.032	0.116			0.038	0.034	0.100	0.036	0.050
11-Aug-93	W	0.030	0.142	0.172	0.030	0.034	0.032	0.008	0.065	0.024	0.046	0.030	0.036	0.044	0.042	0.030	0.040			0.058	0.028	0.036	0.034	
18-Aug-93	D			0.215	0.036	0.052		0.014	0.540		0.074	0.056												0.300
25-Aug-93	D	0.008	0.170	0.270	0.030	0.050	0.022	0.008		0.020	0.052	0.034	0.036		0.036	0.044		0.026	0.118	0.048	0.022		0.024	
1-Sep-93	I	0.014	0.160	0.410	0.030	0.026	0.028	0.006		0.028	0.066	0.032	0.064	0.038	0.048	0.044		0.048	0.032	0.066	0.040	0.146	0.036	0.004
8-Sep-93	I	0.014	0.112	0.098	0.024	0.026		0.002		0.090	0.048	0.030	0.042	0.036	0.048	0.036			0.022	0.018	0.036	0.082	0.044	
15-Sep-93	W	0.012		0.147	0.023	0.024	0.022	0.020		0.023	0.051				0.037	0.031			0.017	0.038	0.024	0.132	0.048	
MayAvg		0.010	0.067	0.065		0.026				0.017	0.022	0.021		0.019		0.023				0.022	0.019	0.029	0.150	
JunAvg		0.020	0.094	0.108	0.035	0.023		0.006	0.032	0.020	0.037	0.024		0.030	0.036	0.036	0.042	0.026	0.068	0.031	0.030	0.047	0.038	0.040
JulyAvg		0.020	0.214	0.175	0.024	0.036		0.032	0.051	0.061	0.061	0.034		0.040	0.065	0.043	0.156	0.049	0.175	0.079	0.032	0.067	0.050	0.055
AugAvg		0.019	0.107	0.219	0.033	0.044	0.027	0.018	0.215	0.033	0.057	0.043	0.036	0.075	0.039	0.035	0.078	0.026	0.118	0.048	0.028	0.068	0.031	0.175
SepAvg		0.013	0.136	0.218	0.026	0.025	0.025	0.009		0.047	0.055	0.031	0.053	0.037	0.044	0.037		0.048	0.024	0.041	0.033	0.120	0.043	0.004
SeasonAvg		0.017	0.130	0.161	0.029	0.032	0.026	0.019	0.110	0.037	0.050	0.032	0.045	0.039	0.050	0.036	0.111	0.040	0.072	0.047	0.029	0.067	0.055	0.069
Dry Max		0.022	0.340	0.270	0.036	0.056	0.022	0.066	0.540	0.056	0.074	0.056	0.036	0.106	0.046	0.050	0.210	0.048	0.175	0.048	0.042	0.100	0.058	0.300
3rd Quart		0.014	0.172	0.190	0.036	0.051	0.022	0.027	0.093	0.028	0.063	0.044	0.036	0.041	0.039	0.046	0.140	0.037	0.147	0.038	0.032	0.076	0.050	0.057
Dry Median		0.011	0.144	0.156	0.028	0.035	0.022	0.008	0.037	0.024	0.056	0.033	0.036	0.031	0.036	0.038	0.106	0.026	0.118	0.034	0.028	0.058	0.044	0.051
Dry Avg		0.011	0.151	0.169	0.029	0.038	0.022	0.021	0.127	0.027	0.058	0.037	0.036	0.045	0.037	0.041	0.116	0.033	0.120	0.036	0.029	0.070	0.043	0.092
1st Quart		0.009	0.109	0.135	0.022	0.029	0.022	0.007	0.033	0.020	0.053	0.030	0.036	0.029	0.036	0.036	0.083	0.037	0.093	0.032	0.024	0.058	0.037	0.050
Dry Min		0.002	0.008	0.110	0.020	0.018	0.022	0.004	0.008	0.014	0.042	0.026	0.036	0.028	0.026	0.032	0.042	0.026	0.068	0.030	0.020	0.058	0.024	0.044
Wet Max		0.052	0.198	0.230	0.030	0.034	0.032	0.048	0.065	0.176	0.062	0.036	0.036	0.070	0.152	0.050	0.162	0.050	0.017	0.215	0.050	0.132	0.280	
3rd Quart		0.036	0.170	0.187	0.028	0.032	0.030	0.034	0.061	0.062	0.057	0.033	0.036	0.057	0.097	0.036	0.132	0.050	0.017	0.097	0.034	0.084	0.112	
Wet Median		0.022	0.142	0.160	0.026	0.030	0.027	0.020	0.058	0.024	0.051	0.030	0.036	0.044	0.042	0.031	0.101	0.050	0.017	0.048	0.026	0.036	0.052	
Wet Avg		0.027	0.139	0.151	0.026	0.029	0.027	0.025	0.058	0.061	0.053	0.029	0.036	0.045	0.077	0.033	0.101	0.050	0.017	0.083	0.031	0.066	0.105	
1st Quart		0.014	0.110	0.124	0.025	0.027	0.025	0.014	0.054	0.022	0.049	0.025	0.036	0.033	0.040	0.028	0.071	0.050	0.017	0.034	0.023	0.033	0.045	
Wet Min		0.012	0.078	0.056	0.023	0.024	0.022	0.008	0.050	0.020	0.046	0.020	0.036	0.022	0.037	0.022	0.040	0.050	0.017	0.020	0.020	0.030	0.034	

APPENDIX F

Spencer Creek 1993 - PHOSPHATE Data

DATE		SAMPLING STATIONS																						
		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	0.0010	0.0500	0.0320						0.0010		0.0010		0.0010		0.0010				0.0030	0.0015	0.0020	0.0015	
19-May-93	I	0.0010	0.0310	0.0450		0.0015				0.0020	0.0010	0.0015		0.0015		0.0025				0.0055	0.0020	0.0025	0.0020	
2-Jun-93	I	0.0015	0.0310	0.0405	0.0015	0.0015				0.0055	0.0015	0.0015		0.0020		0.0020				0.0075	0.0020	0.0040	0.0020	0.0015
16-Jun-93	I	0.0010	0.0520	0.0795	0.0025	0.0010				0.0010	0.0075	0.0015		0.0010		0.0040				0.0035	0.0025	0.0040	0.0020	0.0015
23-Jun-93	D	0.0010	0.0760	0.0765	0.0015	0.0010				0.0010	0.0225	0.0010		0.0020		0.0090				0.0050	0.0060	0.0150	0.0105	0.0020
30-Jun-93	D	0.0010	0.0705	0.0815	0.0010	0.0010		0.0010	0.0085	0.0015	0.0195	0.0015		0.0010	0.0100	0.0075	0.0120	0.0020	0.0025	0.0010	0.0025	0.0155	0.0025	0.0015
7-Jul-93	D	0.0015	0.0010	0.0020	0.0015	0.0015		0.0180	0.0010	0.0020	0.0245	0.0075		0.0040	0.0085	0.0025	0.0230			0.0020	0.0030	0.0190	0.0035	0.0025
14-Jul-93	D	0.0010	0.2950	0.1220	0.0010	0.0010		0.0010	0.0100	0.0010	0.0325	0.0100		0.0090	0.0120	0.0010		0.0040	0.0060	0.0020	0.0010		0.0010	
21-Jul-93	D	0.0025	0.1330	0.1340	0.0010	0.0010		0.0010	0.0120	0.0010	0.0260	0.0070		0.0020	0.0170	0.0060	0.0145			0.0045	0.0020	0.0155	0.0035	0.0050
26-Jul-93	W	0.0080	0.1400	0.1120	0.0010	0.0020		0.0010	0.0210	0.0750	0.0270	0.0040		0.0070	0.0135	0.0035	0.0055	0.0070		0.0250	0.0025		0.0030	
4-Aug-93	D	0.0010	0.1350	0.1300	0.0010	0.0010		0.0010	0.0135	0.0010	0.0305	0.0075		0.0045	0.0190	0.0200	0.0050			0.0045	0.0015	0.0205	0.0020	0.0025
11-Aug-93	W	0.0020	0.1060	0.2100	0.0010	0.0025	0.0030	0.0010	0.0120	0.0085	0.0205	0.0070	0.0010	0.0110	0.0350	0.0020	0.0055			0.0070	0.0015	0.0020	0.0020	
18-Aug-93	D	0.0015		0.1580	0.0010	0.0010		0.0010	0.0220	0.0010	0.0380	0.0245	0.0021	0.0255	0.0200	0.0145		0.0035		0.0055	0.0010	0.0060	0.0020	0.0040
25-Aug-93	D	0.0010	0.1360	0.1420	0.0035	0.0015	0.0105	0.0010		0.0010	0.0370	0.0130	0.0125	0.0250	0.0165	0.0100		0.0055	0.0025	0.0065	0.0010		0.0010	
1-Sep-93	I	0.0040	0.1400	0.1800	0.0015	0.0010	0.0150	0.0010		0.0110	0.0375	0.0100	0.0175	0.0180	0.0305	0.0135		0.0120	0.0035	0.0110	0.0040	0.0485	0.0050	0.0035
8-Sep-93	I	0.0025	0.0680	0.0860	0.0010	0.0010	0.0140	0.0010		0.0085	0.0235	0.0170	0.0155	0.0180	0.0260	0.0180			0.0120	0.0135	0.0160	0.0320	0.0165	
15-Sep-93	W	0.0010	0.0900	0.1200	0.0010	0.0010	0.0135	0.0010		0.0050	0.0270	0.0105	0.0080	0.0125	0.0220	0.0075		0.0110	0.0050	0.0080	0.0015	0.0065	0.0050	
MayAvg		0.0010	0.0405	0.0385		0.0015				0.0015	0.0010	0.0013		0.0013		0.0018				0.0043	0.0018	0.0023	0.0018	
JunAvg		0.0011	0.0574	0.0695	0.0016	0.0011		0.0010	0.0085	0.0023	0.0128	0.0014		0.0015	0.0100	0.0056	0.0120	0.0020	0.0025	0.0043	0.0033	0.0096	0.0043	0.0016
JulyAvg		0.0033	0.1423	0.0925	0.0011	0.0014		0.0053	0.0110	0.0198	0.0275	0.0071		0.0055	0.0128	0.0033	0.0143	0.0055	0.0060	0.0084	0.0021	0.0173	0.0028	0.0038
AugAvg		0.0014	0.1257	0.1600	0.0016	0.0015	0.0068	0.0010	0.0158	0.0029	0.0315	0.0130	0.0052	0.0165	0.0226	0.0116	0.0053	0.0045	0.0025	0.0059	0.0013	0.0095	0.0018	0.0033
SepAvg		0.0025	0.0993	0.1287	0.0012	0.0010	0.0142	0.0010		0.0082	0.0293	0.0125	0.0137	0.0162	0.0262	0.0130		0.0115	0.0068	0.0108	0.0072	0.0290	0.0088	0.0035
SeasonAvg		0.0019	0.0972	0.1030	0.0014	0.0013	0.0112	0.0024	0.0125	0.0075	0.0235	0.0074	0.0094	0.0085	0.0192	0.0073	0.0109	0.0064	0.0053	0.0068	0.0030	0.0138	0.0038	0.0027
Dry Max		0.0025	0.2950	0.1580	0.0035	0.0015	0.0105	0.0180	0.0220	0.0020	0.0380	0.0245	0.0125	0.0255	0.0200	0.0200	0.0230	0.0055	0.0060	0.0065	0.0060	0.0205	0.0105	0.0050
3rd Quart		0.0015	0.1355	0.1360	0.0015	0.0011	0.0105	0.0010	0.0131	0.0011	0.0336	0.0108	0.0099	0.0130	0.0180	0.0111	0.0166	0.0044	0.0043	0.0051	0.0026	0.0181	0.0035	0.0036
Dry Median		0.0010	0.1330	0.1260	0.0010	0.0010	0.0105	0.0010	0.0110	0.0010	0.0283	0.0075	0.0073	0.0043	0.0165	0.0083	0.0133	0.0038	0.0025	0.0045	0.0018	0.0155	0.0023	0.0025
Dry Avg		0.0013	0.1209	0.1058	0.0014	0.0011	0.0105	0.0034	0.0112	0.0012	0.0288	0.0090	0.0073	0.0091	0.0147	0.0088	0.0136	0.0038	0.0037	0.0039	0.0023	0.0153	0.0033	0.0029
1st Quart		0.0010	0.0733	0.0803	0.0010	0.0010	0.0105	0.0010	0.0089	0.0010	0.0240	0.0056	0.0047	0.0020	0.0110	0.0051	0.0103	0.0031	0.0043	0.0020	0.0010	0.0151	0.0018	0.0021
Dry Min		0.0010	0.0010	0.0020	0.0010	0.0010	0.0105	0.0010	0.0010	0.0010	0.0195	0.0010	0.0021	0.0010	0.0085	0.0010	0.0050	0.0020	0.0025	0.0010	0.0010	0.0060	0.0010	0.0015
Wet Max		0.0080	0.1400	0.2100	0.0010	0.0025	0.0135	0.0010	0.0210	0.0750	0.0270	0.0105	0.0080	0.0125	0.0350	0.0075	0.0055	0.0110	0.0050	0.0250	0.0025	0.0065	0.0050	
3rd Quart		0.0035	0.1145	0.1425	0.0010	0.0023	0.0109	0.0010	0.0188	0.0251	0.0270	0.0079	0.0063	0.0114	0.0285	0.0045	0.0055	0.0100	0.0050	0.0123	0.0018	0.0043	0.0035	
Wet Median		0.0015	0.0980	0.1160	0.0010	0.0020	0.0083	0.0010	0.0165	0.0068	0.0270	0.0055	0.0045	0.0090	0.0220	0.0028	0.0055	0.0090	0.0050	0.0075	0.0015	0.0020	0.0025	
Wet Avg		0.0030	0.0965	0.1185	0.0010	0.0018	0.0083	0.0010	0.0165	0.0224	0.0248	0.0056	0.0045	0.0079	0.0235	0.0035	0.0055	0.0090	0.0050	0.0108	0.0018	0.0035	0.0029	
1st Quart		0.0018	0.0800	0.0920	0.0010	0.0015	0.0056	0.0010	0.0143	0.0040	0.0238	0.0033	0.0028	0.0055	0.0178	0.0018	0.0055	0.0080	0.0050	0.0060	0.0023	0.0043	0.0019	
Wet Min		0.0010	0.0500	0.0320	0.0010	0.0010	0.0030	0.0010	0.0120	0.0010	0.0205	0.0010	0.0010	0.0010	0.0135	0.0010	0.0055	0.0070	0.0050	0.0030	0.0015	0.0020	0.0015	

Spencer Creek 1993 - TOTAL KJELDAHL NITROGEN Data

DATE		SAMPLING STATIONS																						
		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	0.360	0.560	0.620						0.480		0.620		0.620		0.660				0.720	0.660	0.680	0.700	
19-May-93	I	0.200	0.320	0.400		0.580				0.400	0.580	0.560		0.540		0.660				0.760	0.660	0.720	0.680	
2-Jun-93	I	0.200	0.460	0.520	0.580	0.580				0.500	0.560	0.540		0.560		0.660				0.780	0.660	0.720	0.700	0.920
16-Jun-93	I	0.580	0.400	0.580	0.900	0.540				0.380	0.580	0.600		0.580		0.720				0.620	0.700	0.820	0.740	0.880
23-Jun-93	D	0.420	0.640	0.760	0.660	0.640				0.700	0.800	0.780		0.860		0.860				0.780	0.820	0.920	0.880	0.960
30-Jun-93	D	0.220	0.400	0.640	0.600	0.560		0.320	0.700	0.500	0.720	0.720		0.700	0.740	0.760	0.500	0.580	1.580	0.580	0.740	0.820	0.800	0.840
7-Jul-93	D	0.280	0.460	0.680	0.560	0.820		0.840	0.260	0.500	0.680	0.680		0.640	0.640	0.720	0.720			0.600	0.660	0.940	0.800	0.880
14-Jul-93	D	0.240	0.540	0.600	0.620	0.640		0.320	1.350	0.460	0.660	0.700		0.620	0.500	0.720		0.760	3.650	0.660	0.600		0.780	
21-Jul-93	D	0.280	0.560	0.620	1.120	0.620		0.900	0.760	1.480	0.760	2.600		0.700	0.740	0.600	1.760			0.620	0.580	0.920	0.620	0.800
26-Jul-93	W	0.920	0.700	1.120	0.640	0.680		1.040	0.700	1.160	0.780	0.660		0.820	1.620	1.000	1.340	0.680		1.500	0.900		0.840	
4-Aug-93	D		0.280		1.040	0.520		0.500	0.480	0.620		0.580		0.740	0.980	0.740	1.000			0.700	0.820	0.980	0.800	0.780
11-Aug-93	W	0.620	0.480	0.660	0.700	0.620	0.540	0.320	0.950	0.380	0.580	0.580	0.580	0.580	0.640	0.660	0.560			0.740	0.740	0.740	0.720	
18-Aug-93	D			0.600	0.740	0.720		0.300	3.850		0.580	0.600												2.200
25-Aug-93	D	0.200	0.460	0.600	0.800	0.780	0.320	0.240		0.320	0.420	0.520	0.500		0.460	0.640		0.480	1.140	0.680	0.620		0.640	
1-Sep-93	I	0.300	0.480	1.050	0.800	0.700	0.380	0.260		0.400	0.620	0.680	1.060	0.500	0.480	0.620		0.680	0.560	0.740	0.720	1.620	0.640	0.280
8-Sep-93	I	0.380	0.600	0.620	0.720	0.660		0.320		0.500	0.760	0.660	0.700	0.720	0.680	0.680			0.420	0.440	0.660	0.740	0.800	
15-Sep-93	W	0.230		0.640	0.650	0.660	0.470	0.440		0.490	0.610				0.510	0.630			0.430	0.570	0.630	1.200	0.700	
MayAvg		0.280	0.440	0.510		0.580				0.440	0.580	0.590		0.580		0.660				0.740	0.660	0.700	0.690	
JunAvg		0.355	0.475	0.625	0.685	0.580		0.320	0.700	0.520	0.665	0.660		0.675	0.740	0.750	0.500	0.580	1.580	0.690	0.730	0.820	0.780	0.900
JulyAvg		0.430	0.565	0.755	0.735	0.690		0.775	0.768	0.900	0.720	1.160		0.695	0.875	0.760	1.273	0.720	3.650	0.845	0.685	0.930	0.760	0.840
AugAvg		0.410	0.407	0.620	0.820	0.660	0.430	0.340	1.760	0.440	0.527	0.570	0.540	0.660	0.693	0.680	0.780	0.480	1.140	0.707	0.727	0.860	0.720	1.490
SepAvg		0.303	0.540	0.770	0.723	0.673	0.425	0.340		0.463	0.663	0.670	0.880	0.610	0.557	0.643		0.680	0.470	0.583	0.670	1.187	0.713	0.280
SeasonAvg		0.362	0.489	0.669	0.742	0.645	0.428	0.483	1.131	0.579	0.646	0.755	0.710	0.656	0.726	0.708	0.980	0.636	1.297	0.718	0.698	0.909	0.740	0.949
Dry Max		0.420	0.640	0.760	1.120	0.820	0.320	0.900	3.850	1.480	0.800	2.600	0.500	0.860	0.980	0.860	1.760	0.760	3.650	0.780	0.820	0.980	0.880	2.200
3rd Quart		0.280	0.550	0.660	0.860	0.735	0.320	0.670	1.203	0.660	0.740	0.735	0.500	0.730	0.740	0.750	1.190	0.670	2.615	0.690	0.780	0.940	0.800	0.940
Dry Median		0.260	0.460	0.620	0.700	0.640	0.320	0.320	0.730	0.500	0.680	0.690	0.500	0.700	0.690	0.720	0.860	0.580	1.580	0.660	0.660	0.920	0.800	0.860
Dry Avg		0.273	0.477	0.643	0.768	0.663	0.320	0.489	1.233	0.654	0.660	0.898	0.500	0.710	0.677	0.720	0.995	0.607	2.123	0.660	0.691	0.916	0.760	1.077
1st Quart		0.225	0.430	0.600	0.615	0.605	0.320	0.310	0.535	0.480	0.620	0.595	0.500	0.655	0.535	0.680	0.665	0.530	1.360	0.610	0.610	0.920	0.710	0.810
Dry Min		0.200	0.280	0.600	0.560	0.520	0.320	0.240	0.260	0.320	0.420	0.520	0.500	0.620	0.460	0.600	0.500	0.480	1.140	0.580	0.580	0.820	0.620	0.780
Wet Max		0.920	0.700	1.120	0.700	0.680	0.540	1.040	0.950	1.160	0.780	0.660	0.580	0.820	1.620	1.000	1.340	0.680	0.430	1.500	0.900	1.200	0.840	
3rd Quart		0.695	0.630	0.775	0.675	0.670	0.523	0.740	0.888	0.658	0.695	0.640	0.580	0.720	1.130	0.745	1.145	0.680	0.430	0.930	0.780	0.970	0.750	
Wet Median		0.490	0.560	0.650	0.650	0.660	0.505	0.440	0.825	0.485	0.610	0.620	0.580	0.620	0.640	0.660	0.950	0.680	0.430	0.730	0.700	0.740	0.710	
Wet Avg		0.533	0.580	0.760	0.663	0.653	0.505	0.600	0.825	0.628	0.657	0.620	0.580	0.673	0.923	0.738	0.950	0.680	0.430	0.883	0.733	0.873	0.740	
1st Quart		0.328	0.520	0.635	0.645	0.640	0.488	0.380	0.763	0.455	0.595	0.600	0.580	0.600	0.575	0.653	0.755	0.680	0.430	0.683	0.653	0.710	0.715	
Wet Min		0.230	0.480	0.620	0.640	0.620	0.470	0.320	0.700	0.380	0.580	0.580	0.580	0.580	0.510	0.630	0.560	0.680	0.430	0.570	0.630	0.680	0.700	

APPENDIX F

Spencer Creek 1993 - AMMONIUM Data

		SAMPLING STATIONS																						
DATE		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	w	0.004	0.008	0.004						0.002		0.036		0.010		0.014				0.002	0.012	0.010	0.014	
19-May-93	I	0.002	0.006	0.004		0.048				0.002	0.020	0.026		0.012		0.020				0.062	0.010	0.030	0.012	
2-Jun-93	I	0.002	0.002	0.002	0.026	0.016				0.002	0.002	0.002		0.002		0.002				0.054	0.002	0.012	0.002	0.022
16-Jun-93	I	0.002	0.010	0.034	0.012	0.020				0.002	0.018	0.026		0.008		0.036				0.032	0.024	0.018	0.038	0.030
23-Jun-93	D	0.002	0.036	0.006	0.030	0.054				0.002	0.018	0.018		0.008		0.026				0.020	0.024	0.110	0.050	0.118
30-Jun-93	D	0.004	0.030	0.008	0.038	0.042		0.004	0.002	0.002	0.024	0.006		0.006	0.002	0.008	0.016	0.016	0.188	0.004	0.002	0.062	0.002	0.022
7-Jul-93	D	0.002	0.080	0.054	0.008	0.022		0.002	0.002	0.002	0.088	0.060		0.010	0.020	0.002	0.136			0.032	0.002	0.074	0.042	0.070
14-Jul-93	D	0.020	0.120	0.044	0.026	0.056		0.010	0.008	0.006	0.062	0.056		0.010	0.010	0.020		0.086	0.380	0.060	0.024		0.034	
21-Jul-93	D	0.002	0.028	0.014	0.016	0.020		0.004	0.006	0.002	0.018	0.022		0.002	0.004	0.002	0.008			0.038	0.004	0.024	0.010	0.042
26-Jul-93	W	0.002	0.074	0.054	0.014	0.030		0.008	0.002	0.108	0.106	0.048		0.030	0.116	0.048	0.070	0.102		0.122	0.034		0.086	
4-Aug-93	D	0.002	0.028	0.004	0.030	0.030		0.004	0.002	0.004	0.052	0.010		0.002	0.026	0.080	0.002			0.024	0.010	0.090	0.018	0.006
11-Aug-93	W	0.002	0.036	0.002	0.022	0.008	0.002	0.002	0.002	0.002	0.030	0.018	0.002	0.004	0.016	0.006	0.004			0.002	0.014	0.010	0.032	
18-Aug-93	D	0.002	0.088	0.002	0.030	0.008		0.002	0.068	0.002	0.062	0.046	0.016	0.010	0.040	0.020		0.026		0.048	0.018	0.028	0.028	0.022
25-Aug-93	D	0.002	0.142	0.016	0.110	0.032	0.002	0.002		0.002	0.076	0.026	0.020	0.018	0.022	0.030		0.036	0.048	0.070	0.040		0.034	
1-Sep-93	I	0.002	0.134	0.046	0.032	0.024		0.002		0.004	0.064	0.088	0.010	0.012	0.018	0.014		0.034	0.006	0.050	0.014	0.148	0.032	0.030
8-Sep-93	I	0.004	0.044	0.022	0.008	0.020	0.018	0.006		0.002	0.018	0.048	0.014	0.006	0.026	0.014			0.026	0.074	0.016	0.018	0.030	
15-Sep-93	W	0.002	0.068	0.010	0.012	0.026	0.004	0.002		0.002	0.034	0.060	0.004	0.010	0.010	0.008		0.036	0.016	0.118	0.010	0.018	0.024	
MayAvg		0.003	0.007	0.004		0.048				0.002	0.020	0.031		0.011		0.017				0.032	0.011	0.020	0.013	
JunAvg		0.003	0.020	0.013	0.027	0.033		0.004	0.002	0.002	0.016	0.013		0.006	0.002	0.018	0.016	0.016	0.188	0.028	0.013	0.051	0.023	0.048
JulyAvg		0.007	0.076	0.042	0.016	0.032		0.006	0.005	0.030	0.069	0.047		0.013	0.038	0.018	0.071	0.094	0.380	0.063	0.016	0.049	0.043	0.056
AugAvg		0.002	0.074	0.006	0.048	0.020	0.002	0.003	0.024	0.003	0.055	0.025	0.013	0.009	0.026	0.034	0.003	0.031	0.048	0.036	0.021	0.043	0.028	0.014
SepAvg		0.003	0.082	0.026	0.017	0.023	0.011	0.003		0.003	0.039	0.065	0.009	0.009	0.018	0.012		0.035	0.016	0.081	0.013	0.061	0.029	0.030
SeasonAvg		0.003	0.055	0.019	0.028	0.029	0.007	0.004	0.012	0.009	0.043	0.035	0.011	0.009	0.026	0.021	0.039	0.048	0.111	0.048	0.015	0.047	0.029	0.040
Dry Max		0.020	0.142	0.054	0.110	0.056	0.002	0.010	0.068	0.006	0.088	0.060	0.020	0.018	0.040	0.080	0.136	0.086	0.380	0.070	0.040	0.110	0.050	0.118
3rd Quart		0.003	0.096	0.023	0.032	0.045	0.002	0.004	0.008	0.003	0.066	0.049	0.019	0.010	0.024	0.027	0.046	0.049	0.284	0.051	0.024	0.086	0.036	0.063
Dry Median		0.003	0.058	0.011	0.030	0.031	0.002	0.004	0.004	0.002	0.057	0.024	0.018	0.009	0.020	0.020	0.012	0.031	0.188	0.035	0.014	0.068	0.031	0.032
Dry Avg		0.005	0.069	0.019	0.036	0.033	0.002	0.004	0.015	0.003	0.050	0.031	0.018	0.008	0.018	0.024	0.041	0.041	0.205	0.037	0.016	0.065	0.027	0.047
1st Quart		0.002	0.030	0.006	0.024	0.022	0.002	0.002	0.002	0.002	0.023	0.016	0.017	0.005	0.007	0.007	0.007	0.024	0.118	0.023	0.004	0.037	0.016	0.022
Dry Min		0.002	0.028	0.002	0.008	0.008	0.002	0.002	0.002	0.002	0.018	0.006	0.016	0.002	0.002	0.002	0.002	0.016	0.048	0.004	0.002	0.024	0.002	0.006
Wet Max		0.004	0.074	0.054	0.022	0.030	0.004	0.008	0.002	0.108	0.106	0.060	0.004	0.030	0.116	0.048	0.070	0.102	0.016	0.122	0.034	0.018	0.086	
3rd Quart		0.003	0.070	0.021	0.018	0.028	0.004	0.005	0.002	0.029	0.070	0.051	0.004	0.015	0.066	0.023	0.054	0.086	0.016	0.119	0.019	0.014	0.046	
Wet Median		0.002	0.052	0.007	0.014	0.026	0.003	0.002	0.002	0.002	0.034	0.042	0.003	0.010	0.016	0.011	0.037	0.069	0.016	0.060	0.013	0.010	0.028	
Wet Avg		0.003	0.047	0.018	0.016	0.021	0.003	0.004	0.002	0.029	0.057	0.041	0.003	0.014	0.047	0.019	0.037	0.069	0.016	0.061	0.018	0.013	0.039	
1st Quart		0.004	0.029	0.004	0.013	0.017	0.003	0.005	0.002	0.082	0.032	0.032	0.003	0.009	0.013	0.008	0.021	0.053	0.016	0.089	0.012	0.014	0.022	
Wet Min		0.002	0.008	0.002	0.012	0.008	0.002	0.002	0.002	0.002	0.030	0.018	0.002	0.004	0.010	0.006	0.004	0.036	0.016	0.002	0.010	0.010	0.014	

Spencer Creek 1993 - NITRATE Data

		SAMPLING STATIONS																						
DATE		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	0.720	0.230	0.030						0.800		0.230		0.285		0.350				1.130	0.405	1.220	0.585	
19-May-93	I	0.865	0.365	0.025		0.050				0.985	0.735	0.410		0.400		0.685				2.000	0.790	1.550	0.895	
2-Jun-93	I	0.850	0.185	0.020	0.010	0.010				0.645	0.340	0.240		0.285		0.530				2.350	0.635	1.790	0.750	1.200
16-Jun-93	I	0.940	0.100	0.060	0.010	0.005				0.850	0.335	0.015		0.090		0.480				2.810	0.650	1.540	0.640	0.410
23-Jun-93	D	0.830	0.110	0.045	0.005	0.005				0.215	0.060	0.010		0.045		0.235				2.300	0.395	2.650	0.695	0.185
30-Jun-93	D	0.985	0.130	0.080	0.005	0.015		0.895	0.005	0.685	0.235	0.030		0.035	1.940	0.240	0.805	2.730	2.670	2.970	0.285	1.770	0.380	0.250
7-Jul-93	D	0.875	0.150	0.170	0.015	0.035		0.005	0.655	0.710	0.450	0.035		0.165	2.380	0.525	0.380			0.010	0.590	1.140	0.395	0.045
14-Jul-93	D	1.010	0.105	0.150	0.020	0.045		0.680	0.005	0.685	0.290	0.040		0.080	2.390	0.300		2.660	2.770	2.840	0.300		0.275	
21-Jul-93	D	0.955	0.120	0.120	0.005	0.020		0.570	0.005	0.445	0.195	0.045		0.050	2.280	0.255	0.005			3.200	0.210	2.260	0.305	0.495
26-Jul-93	W	0.140	0.350	0.240	0.025	0.025		0.615	0.035	0.865	0.480	0.070		0.130	1.960	0.515	0.010	2.770		2.850	0.585		0.185	
4-Aug-93	D	0.990	0.120	0.130	0.005	0.035		0.620	0.005	0.745	0.310	0.065		0.060	2.530	0.145	0.005			2.910	0.035	0.280	0.130	0.010
11-Aug-93	W	0.450	0.180	0.070	0.005	0.075	0.850	0.715	0.005	1.550	0.530	0.050	0.015	0.075	2.010	0.325	2.930			2.760	0.460	0.270	0.160	
18-Aug-93	D	0.920	0.140	0.110	0.005	0.125		0.630	0.025	0.845	0.440	0.030	0.070	0.125	2.010	0.475		3.240		2.600	0.495	0.220	0.335	0.005
25-Aug-93	D	1.000	0.180	0.130	0.010	6.100	1.830	0.680		1.020	0.495	6.500	6.500	0.075	1.790	0.525		3.210	2.860	2.360	0.555		0.175	
1-Sep-93	I	0.990	0.185	0.160	0.015	0.085	1.610	0.530		0.800	0.190	0.015	0.070	0.115	1.940	0.295		2.810	2.870	2.410	0.270	0.300	0.110	0.015
8-Sep-93	I	0.845	0.245	0.035	0.005	0.015	1.260	0.640		0.500	0.195	0.110	0.080	0.115	1.520	0.210			3.050	3.510	0.440	14.600	1.280	
15-Sep-93	W	0.860	0.255	0.060	0.005	0.020	1.340	0.585		0.715	0.255	0.090	0.100	0.115	1.690	0.170		3.240	3.260	2.830	0.175	2.140	0.180	
MayAvg		0.793	0.298	0.028		0.050				0.893	0.735	0.320		0.343		0.518				1.565	0.598	1.385	0.740	
JunAvg		0.901	0.131	0.051	0.008	0.009		0.895	0.005	0.599	0.243	0.074		0.114	1.940	0.371	0.805	2.730	2.670	2.608	0.491	1.938	0.616	0.511
JulyAvg		0.745	0.181	0.170	0.016	0.031		0.468	0.175	0.676	0.354	0.048		0.106	2.253	0.399	0.132	2.715	2.770	2.225	0.421	1.700	0.290	0.270
AugAvg		0.840	0.155	0.110	0.006	1.584	1.340	0.661	0.012	1.040	0.444	1.661	2.195	0.084	2.085	0.368	1.468	3.225	2.860	2.658	0.386	0.257	0.200	0.008
SepAvg		0.898	0.228	0.085	0.008	0.040	1.403	0.585		0.672	0.213	0.072	0.083	0.115	1.717	0.225		3.025	3.060	2.917	0.295	5.680	0.523	0.015
SeasonAvg		0.837	0.185	0.096	0.010	0.417	1.378	0.597	0.093	0.768	0.346	0.470	1.139	0.132	2.037	0.368	0.689	2.951	2.913	2.461	0.428	2.266	0.440	0.291
Dry Max		1.010	0.180	0.170	0.020	6.100	1.830	0.895	0.655	1.020	0.495	6.500	6.500	0.165	2.530	0.525	0.805	3.240	2.860	3.200	0.590	2.650	0.695	0.495
3rd Quart		0.993	0.143	0.135	0.011	0.065	1.830	0.680	0.020	0.770	0.443	0.050	4.893	0.091	2.385	0.488	0.486	3.218	2.815	2.925	0.510	2.138	0.384	0.234
Dry Median		0.970	0.125	0.125	0.005	0.035	1.830	0.630	0.005	0.698	0.300	0.038	3.285	0.068	2.280	0.278	0.193	2.970	2.770	2.720	0.348	1.455	0.320	0.115
Dry Avg		0.946	0.132	0.117	0.009	0.798	1.830	0.583	0.117	0.669	0.309	0.844	3.285	0.079	2.189	0.338	0.299	2.960	2.767	2.399	0.358	1.387	0.336	0.165
1st Quart		0.909	0.118	0.103	0.005	0.019	1.830	0.595	0.005	0.625	0.225	0.030	1.678	0.049	1.975	0.239	0.286	2.713	2.720	2.345	0.266	0.495	0.250	0.019
Dry Min		0.830	0.105	0.045	0.005	0.005	1.830	0.005	0.005	0.215	0.060	0.010	0.070	0.035	1.790	0.145	0.005	2.660	2.670	0.010	0.035	0.220	0.130	0.005
Wet Max		0.860	0.350	0.240	0.025	0.075	1.340	0.715	0.035	1.550	0.530	0.230	0.100	0.285	2.010	0.515	2.930	3.240	3.260	2.850	0.585	2.140	0.585	
3rd Quart		0.755	0.279	0.113	0.015	0.050	1.218	0.665	0.028	1.036	0.505	0.125	0.079	0.169	1.985	0.391	2.200	3.123	3.260	2.835	0.491	1.680	0.285	
Wet Median		0.585	0.243	0.065	0.005	0.025	1.095	0.615	0.020	0.833	0.480	0.080	0.058	0.123	1.960	0.338	1.470	3.005	3.260	2.795	0.433	1.220	0.183	
Wet Avg		0.543	0.254	0.100	0.012	0.040	1.095	0.638	0.020	0.983	0.422	0.110	0.058	0.151	1.887	0.340	1.470	3.005	3.260	2.393	0.406	1.210	0.278	
1st Quart		0.373	0.218	0.053	0.015	0.023	0.973	0.600	0.013	0.779	0.368	0.065	0.036	0.105	1.825	0.286	0.740	2.888	3.260	2.353	0.348	0.745	0.175	
Wet Min		0.140	0.180	0.030	0.005	0.020	0.850	0.585	0.005	0.715	0.255	0.050	0.015	0.075	1.690	0.170	0.010	2.770	3.260	1.130	0.175	0.270	0.160	

APPENDIX F

Spencer Creek 1993 - NITRITE Data

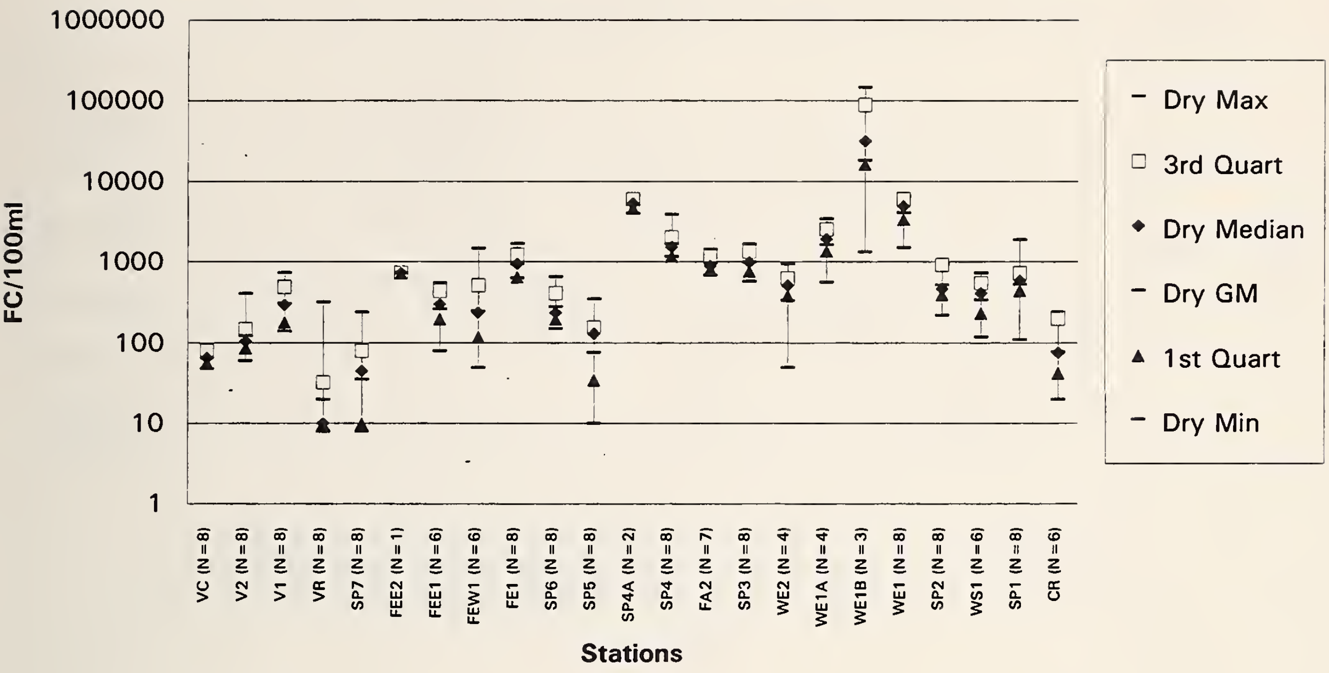
		SAMPLING STATIONS																						
DATE		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	0.0050	0.0150	0.0090						0.0060		0.0090		0.0110		0.0130				0.0180	0.0150	0.0160	0.0140	
19-May-93	I	0.0010	0.0070	0.0030		0.0060				0.0030	0.0080	0.0070		0.0060		0.0110				0.0260	0.0120	0.0140	0.0120	
2-Jun-93	I	0.0010	0.0050	0.0040	0.0030	0.0020				0.0030	0.0070	0.0070		0.0040		0.0080				0.0380	0.0090	0.0180	0.0120	0.0770
16-Jun-93	I	0.0010	0.0050	0.0070	0.0020	0.0040				0.0030	0.0160	0.0060		0.0050		0.0140				0.0590	0.0170	0.0340	0.0230	0.0090
23-Jun-93	D	0.0020	0.0080	0.0060	0.0020	0.0030				0.0030	0.0070	0.0050		0.0050		0.0090				0.0410	0.0130	0.0560	0.0260	0.0180
30-Jun-93	D	0.0020	0.0070	0.0070	0.0010	0.0020		0.0010	0.0040	0.0020	0.0090	0.0050		0.0050	0.0170	0.0070	0.0110	0.0260	0.0370	0.0370	0.0060	0.0370	0.0090	0.0120
7-Jul-93	D	0.0010	0.0130	0.0210	0.0010	0.0040		0.0020	0.0030	0.0020	0.0240	0.0100		0.0060	0.0300	0.0170	0.0150			0.0440	0.0140	0.0720	0.0180	0.0090
14-Jul-93	D	0.0030	0.0150	0.0230	0.0040	0.0060		0.0030	0.0040	0.0050	0.0170	0.0070		0.0050	0.0100	0.0080		0.0360	0.0470	0.0520	0.0120		0.0080	
21-Jul-93	D	0.0020	0.0090	0.0110	0.0030	0.0040		0.0030	0.0010	0.0050	0.0090	0.0060		0.0040	0.0170	0.0060	0.0040			0.0590	0.0050	0.0750	0.0090	0.0220
26-Jul-93	W	0.0100	0.0250	0.0570	0.0030	0.0050		0.0060	0.0120	0.0120	0.0210	0.0090		0.0070	0.0220	0.0130	0.0040	0.0440		0.0870	0.0190		0.0110	
4-Aug-93	D	0.0010	0.0110	0.0030	0.0020	0.0060		0.0020	0.0010	0.0040	0.0110	0.0100		0.0050	0.0250	0.0070	0.0020			0.0680	0.0050	0.0320	0.0060	0.0100
11-Aug-93	W	0.0030	0.0130	0.0040	0.0020	0.0070	0.0050	0.0030	0.0010	0.0080	0.0160	0.0140	0.0050	0.0060	0.0110	0.0100	0.0400			0.0570	0.0120	0.0090	0.0070	
18-Aug-93	D	0.0010	0.0230	0.0020	0.0010	0.0040		0.0010	0.0060	0.0040	0.0200	0.0120	0.0050	0.0050	0.0130	0.0140		0.0500		0.0620	0.0130	0.0130	0.0130	0.0030
25-Aug-93	D	0.0030	0.0290	0.0070	0.0020	0.0040	0.0060	0.0030		0.0050	0.0200	0.0080	0.0040	0.0050	0.0060	0.0120		0.0410	0.0480	0.0680			0.0110	
1-Sep-93	I	0.0020	0.0230	0.0100	0.0030	0.0040	0.0060	0.0030		0.0040	0.0140	0.0120	0.0050	0.0060	0.0070	0.0090		0.0470	0.0470	0.0610	0.0080	0.0230	0.0070	0.0050
8-Sep-93	I	0.0030	0.0110	0.0050	0.0030	0.0050	0.0070	0.0040		0.0040	0.0090	0.0110	0.0050	0.0070	0.0080	0.0070			0.0440	0.0520	0.0080	0.0520	0.0170	
15-Sep-93	W	0.0020	0.0180	0.0050	0.0020	0.0030	0.0060	0.0030		0.0030	0.0100	0.0130	0.0060	0.0060	0.0060	0.0060		0.0450	0.0560	0.0670	0.0070	0.0630	0.0080	
MayAvg		0.0030	0.0110	0.0060		0.0060				0.0045	0.0080	0.0080		0.0085		0.0120				0.0220	0.0135	0.0150	0.0130	
JunAvg		0.0015	0.0063	0.0060	0.0020	0.0028		0.0010	0.0040	0.0028	0.0098	0.0058		0.0048	0.0170	0.0095	0.0110	0.0260	0.0370	0.0438	0.0113	0.0363	0.0175	0.0290
JulyAvg		0.0040	0.0155	0.0280	0.0028	0.0048		0.0035	0.0050	0.0060	0.0178	0.0080		0.0055	0.0198	0.0110	0.0077	0.0400	0.0470	0.0605	0.0125	0.0735	0.0115	0.0155
AugAvg		0.0020	0.0190	0.0040	0.0018	0.0053	0.0055	0.0023	0.0027	0.0053	0.0168	0.0110	0.0047	0.0053	0.0138	0.0108	0.0210	0.0455	0.0480	0.0638	0.0100	0.0180	0.0093	0.0065
SepAvg		0.0023	0.0173	0.0067	0.0027	0.0040	0.0063	0.0033		0.0037	0.0110	0.0120	0.0053	0.0063	0.0070	0.0073		0.0460	0.0490	0.0600	0.0077	0.0460	0.0107	0.0050
SeasonAvg		0.0025	0.0139	0.0108	0.0023	0.0043	0.0060	0.0028	0.0040	0.0045	0.0136	0.0089	0.0050	0.0058	0.0143	0.0101	0.0127	0.0413	0.0465	0.0527	0.0109	0.0367	0.0124	0.0183
Dry Max		0.0030	0.0290	0.0230	0.0040	0.0060	0.0060	0.0030	0.0060	0.0050	0.0240	0.0120	0.0050	0.0060	0.0300	0.0170	0.0150	0.0500	0.0480	0.0680	0.0140	0.0750	0.0260	0.0220
3rd Quart		0.0023	0.0170	0.0135	0.0023	0.0045	0.0060	0.0030	0.0040	0.0050	0.0200	0.0100	0.0048	0.0050	0.0210	0.0125	0.0120	0.0433	0.0475	0.0635	0.0130	0.0680	0.0143	0.0165
Dry Median		0.0020	0.0120	0.0070	0.0020	0.0040	0.0060	0.0020	0.0035	0.0040	0.0140	0.0075	0.0045	0.0050	0.0170	0.0085	0.0075	0.0385	0.0470	0.0555	0.0120	0.0465	0.0100	0.0110
Dry Avg		0.0019	0.0144	0.0100	0.0020	0.0041	0.0060	0.0021	0.0032	0.0038	0.0146	0.0079	0.0045	0.0050	0.0169	0.0100	0.0080	0.0383	0.0440	0.0539	0.0097	0.0475	0.0125	0.0123
1st Quart		0.0010	0.0088	0.0053	0.0010	0.0038	0.0060	0.0015	0.0015	0.0028	0.0090	0.0058	0.0043	0.0050	0.0115	0.0070	0.0035	0.0335	0.0420	0.0433	0.0055	0.0333	0.0088	0.0093
Dry Min		0.0010	0.0070	0.0020	0.0010	0.0020	0.0060	0.0010	0.0010	0.0020	0.0070	0.0050	0.0040	0.0040	0.0060	0.0060	0.0020	0.0260	0.0370	0.0370	0.0050	0.0130	0.0060	0.0030
Wet Max		0.0100	0.0250	0.0570	0.0030	0.0070	0.0060	0.0060	0.0120	0.0120	0.0210	0.0140	0.0060	0.0110	0.0220	0.0130	0.0400	0.0450	0.0560	0.0870	0.0190	0.0630	0.0140	
3rd Quart		0.0063	0.0198	0.0210	0.0025	0.0060	0.0058	0.0045	0.0093	0.0090	0.0185	0.0133	0.0058	0.0080	0.0165	0.0130	0.0310	0.0448	0.0560	0.0720	0.0160	0.0395	0.0118	
Wet Median		0.0040	0.0165	0.0070	0.0020	0.0050	0.0055	0.0030	0.0065	0.0070	0.0160	0.0110	0.0055	0.0065	0.0110	0.0115	0.0220	0.0445	0.0560	0.0620	0.0135	0.0160	0.0095	
Wet Avg		0.0050	0.0178	0.0188	0.0023	0.0050	0.0055	0.0040	0.0065	0.0073	0.0157	0.0113	0.0055	0.0075	0.0130	0.0105	0.0220	0.0445	0.0560	0.0573	0.0133	0.0293	0.0100	
1st Quart		0.0028	0.0145	0.0048	0.0025	0.0040	0.0053	0.0045	0.0038	0.0053	0.0130	0.0120	0.0053	0.0068	0.0085	0.0090	0.0130	0.0443	0.0560	0.0473	0.0108	0.0125	0.0078	
Wet Min		0.0020	0.0130	0.0040	0.0020	0.0030	0.0050	0.0030	0.0010	0.0030	0.0100	0.0090	0.0050	0.0060	0.0060	0.0060	0.0040	0.0440	0.0560	0.0180	0.0070	0.0090	0.0070	

Spencer Creek 1993 - DISOLVED ORGANIC CARBON Data

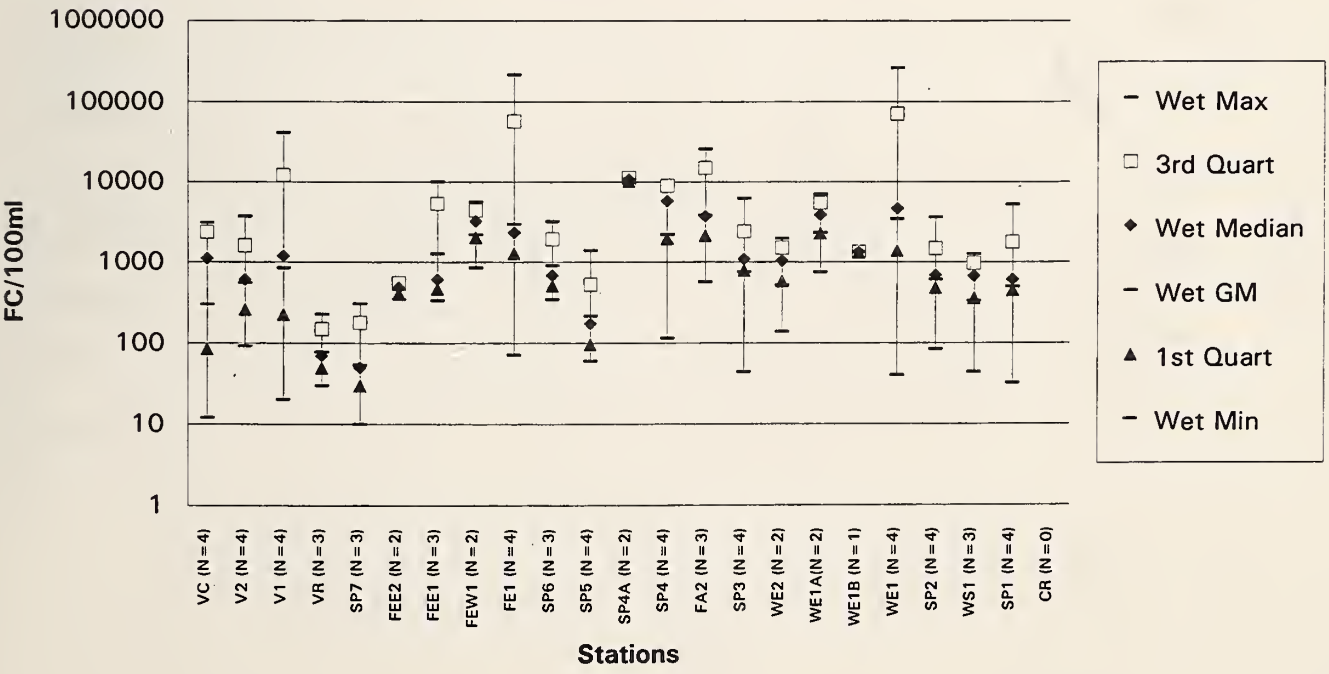
		SAMPLING STATIONS																						
DATE		VC	V2	V1	VR	SP7	FEE2	FEE1	FEW1	FE1	SP6	SP5	SP4A	SP4	FA2	SP3	WE2	WE1A	WE1B	WE1	SP2	WS1	SP1	CR
4-May-93	W	2.1	5.7	7.1						5.0		8.9		8.7		9.2				6.9	9.0	5.5	8.4	
19-May-93	I	1.7	3.1	5.2		4.9				4.0	7.2	7.6		7.4		8.3				6.0	7.8	5.9	7.7	
2-Jun-93	I	2.0	4.9	6.0	5.2	5.2				5.6	8.2	8.1		7.4		7.8				5.6	7.7	5.8	7.3	7.5
16-Jun-93	I	1.2	2.9	6.0	6.0	5.3				3.5	7.4	8.4		8.3		8.4				4.1	8.2	6.3	8.1	7.1
23-Jun-93	D	2.9	8.1	10.1	5.7	5.7				10.9	14.1	14.0		13.1		12.1				6.3	11.1	6.6	10.3	8.1
30-Jun-93	D	1.5	3.3	7.2	5.7	5.4		3.4	11.4	6.1	10.3	11.3		11.2	7.0	11.2	4.6	3.8	4.4	3.9	11.2	5.3	10.9	11.0
7-Jul-93	D	2.2	3.7	8.1	6.0	6.2		14.3	4.0	6.5	7.3	9.3		9.1	4.5	8.7	4.4			3.7	8.2	6.8	8.7	9.2
14-Jul-93	D	1.4	3.9	7.2	5.9	5.7		3.4	13.8	5.8	9.6	9.9		8.8	3.1	7.6		3.4	5.0	3.6	7.3		7.6	
21-Jul-93	D	1.7	5.0	7.1	6.2	5.9		4.9	14.3	8.5	11.2	10.8		9.7	4.5	7.9	7.0			3.7	7.5	6.2	7.5	7.7
26-Jul-93	W	12.8	6.4	10.9	6.1	6.2		7.8	12.5	6.8	7.9	8.9		9.5	4.1	8.5	6.3	3.6		6.6	17.9		8.9	
4-Aug-93	D	1.4	3.3	6.9	6.2	6.1		3.7	15.1	5.8	11.8	12.4		12.1	4.8	11.7	5.7			3.7	11.5	6.0	11.7	9.8
11-Aug-93	W	6.3	4.5	7.4	6.3	6.0	3.5	3.3	14.3	3.8	6.6	8.2	8.4	8.5	3.3	8.1	3.0			3.7	8.0	8.1	8.6	
18-Aug-93	D	1.4	3.3	6.1	6.3	6.2		2.8	16.0	3.4	6.0	7.6	7.7	7.9	3.0	7.7		2.9		3.6	7.5	7.7	8.0	9.2
25-Aug-93	D	1.4	3.0	5.8	6.4	6.1	2.3	2.7		2.8	4.5	6.5	6.5	6.9	2.8	6.5		2.7	3.8	0.1	6.3		6.8	
1-Sep-93	I	1.2	3.1	6.2	6.6	6.3	2.9	3.2		3.5	7.8	8.0	7.2	7.1	2.9	6.6		3.0	3.0	3.6	6.2	11.3	5.9	8.7
8-Sep-93	I	2.6	7.1	8.8	6.5	6.3	5.5	5.0		8.5	12.5	12.9	12.5	12.4	6.1	12.0			3.1	3.2	11.4	5.5	10.8	
15-Sep-93	W	2.1	4.9	8.9	6.3	6.2	4.4	3.8		5.9	11.0	11.1	10.9	11.1	4.4	10.7		2.7	2.9	3.4	10.7	4.8	10.4	
MayAvg		1.9	4.4	6.2		4.9				4.5	7.2	8.3		8.1		8.8				6.5	8.4	5.7	8.1	
JunAvg		1.9	4.8	7.3	5.7	5.4		3.4	11.4	6.5	10.0	10.5		10.0	7.0	9.9	4.6	3.8	4.4	5.0	9.6	6.0	9.2	8.4
JulyAvg		4.5	4.8	8.3	6.1	6.0		7.6	11.2	6.9	9.0	9.7		9.3	4.1	8.2	5.9	3.5	5.0	4.4	10.2	6.5	8.2	8.5
AugAvg		2.6	3.5	6.6	6.3	6.1	2.9	3.1	15.1	4.0	7.2	8.7	7.5	8.9	3.5	8.5	4.4	2.8	3.8	2.8	8.3	7.3	8.8	9.5
SepAvg		2.0	5.0	8.0	6.5	6.3	4.3	4.0		6.0	10.4	10.7	10.2	10.2	4.5	9.8		2.9	3.0	3.4	9.4	7.2	9.0	8.7
SeasonAvg		2.7	4.5	7.4	6.1	5.9	3.7	4.9	12.7	5.7	9.0	9.6	8.9	9.4	4.2	9.0	5.2	3.2	3.7	4.2	9.3	6.6	8.7	8.7
Dry Max		2.9	8.1	10.1	6.4	6.2	2.3	14.3	16.0	10.9	14.1	14.0	7.7	13.1	7.0	12.1	7.0	3.8	5.0	6.3	11.5	7.7	11.7	11.0
3rd Quart		1.8	4.2	7.4	6.2	6.1	2.3	4.3	14.9	7.0	11.4	11.6	7.4	11.4	4.7	11.3	6.0	3.5	4.7	3.8	11.1	6.8	10.5	9.7
Dry Median		1.5	3.5	7.2	6.1	6.0	2.3	3.4	14.1	6.0	10.0	10.4	7.1	9.4	4.5	8.3	5.2	3.2	4.4	3.7	7.9	6.4	8.4	9.2
Dry Avg		1.7	4.2	7.3	6.1	5.9	2.3	5.0	12.4	6.2	9.4	10.2	7.1	9.9	4.2	9.2	5.4	3.2	4.4	3.6	8.8	6.4	8.9	9.2
1st Quart		1.4	3.3	6.7	5.9	5.7	2.3	3.1	12.0	5.2	7.0	8.9	6.8	8.6	3.1	7.7	4.6	2.9	4.1	3.6	7.5	6.1	7.6	8.4
Dry Min		1.4	3.0	5.8	5.7	5.4	2.3	2.7	4.0	2.8	4.5	6.5	6.5	6.9	2.8	6.5	4.4	2.7	3.8	0.1	6.3	5.3	6.8	7.7
Wet Max		12.8	6.4	10.9	6.3	6.2	4.4	7.8	14.3	6.8	11.0	11.1	10.9	11.1	4.4	10.7	6.3	3.6	2.9	6.9	17.9	8.1	10.4	
3rd Quart		7.9	5.9	9.4	6.3	6.2	4.2	5.8	13.9	6.1	9.5	9.5	10.3	9.9	4.3	9.6	5.5	3.4	2.9	6.7	12.5	6.8	9.3	
Wet Median		4.2	5.3	8.2	6.3	6.2	4.0	3.8	13.4	5.5	7.9	8.9	9.7	9.1	4.1	8.9	4.7	3.2	2.9	5.2	9.9	5.5	8.8	
Wet Avg		5.8	5.4	8.6	6.2	6.1	4.0	5.0	13.4	5.4	8.5	9.3	9.7	9.5	3.9	9.1	4.7	3.2	2.9	5.2	11.4	6.1	9.1	
1st Quart		5.3	4.8	7.3	6.2	6.1	3.7	3.6	13.0	4.7	7.3	8.7	9.0	8.7	3.7	8.4	3.8	2.9	2.9	3.6	8.8	5.2	8.6	
Wet Min		2.1	4.5	7.1	6.1	6.0	3.5	3.3	12.5	3.8	6.6	8.2	8.4	8.5	3.3	8.1	3.0	2.7	2.9	3.4	8.0	4.8	8.4	

APPENDIX F

Spencer Creek DRY Weather Sampling
FECAL COLIFORM Concentrations

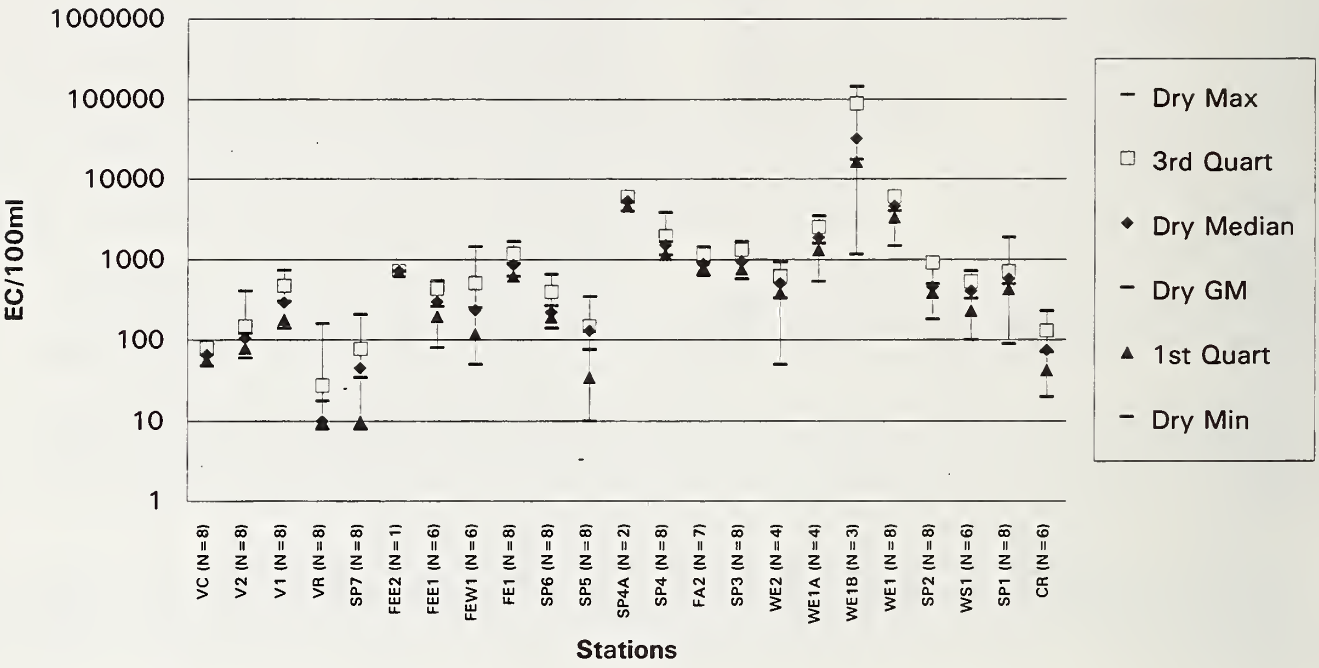


Spencer Creek WET Weather Sampling
FECAL COLIFORM Concentrations

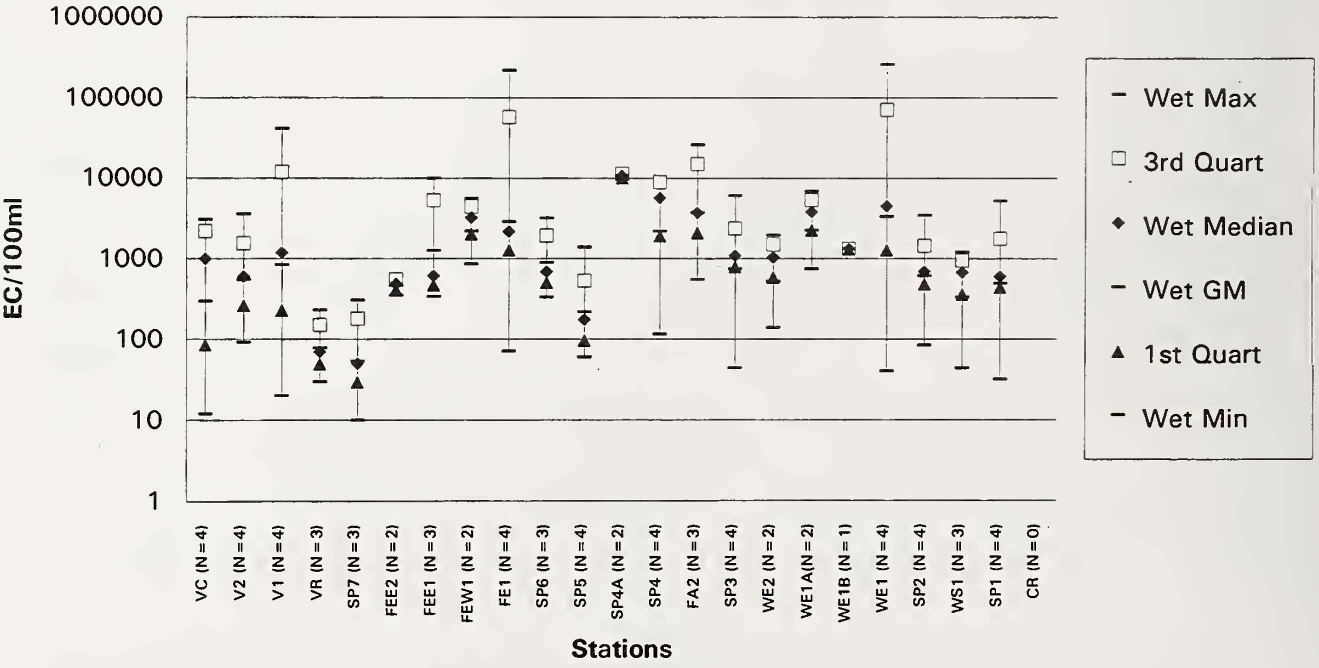


APPENDIX F

Spencer Creek DRY Weather Sampling
E. COLI Concentrations

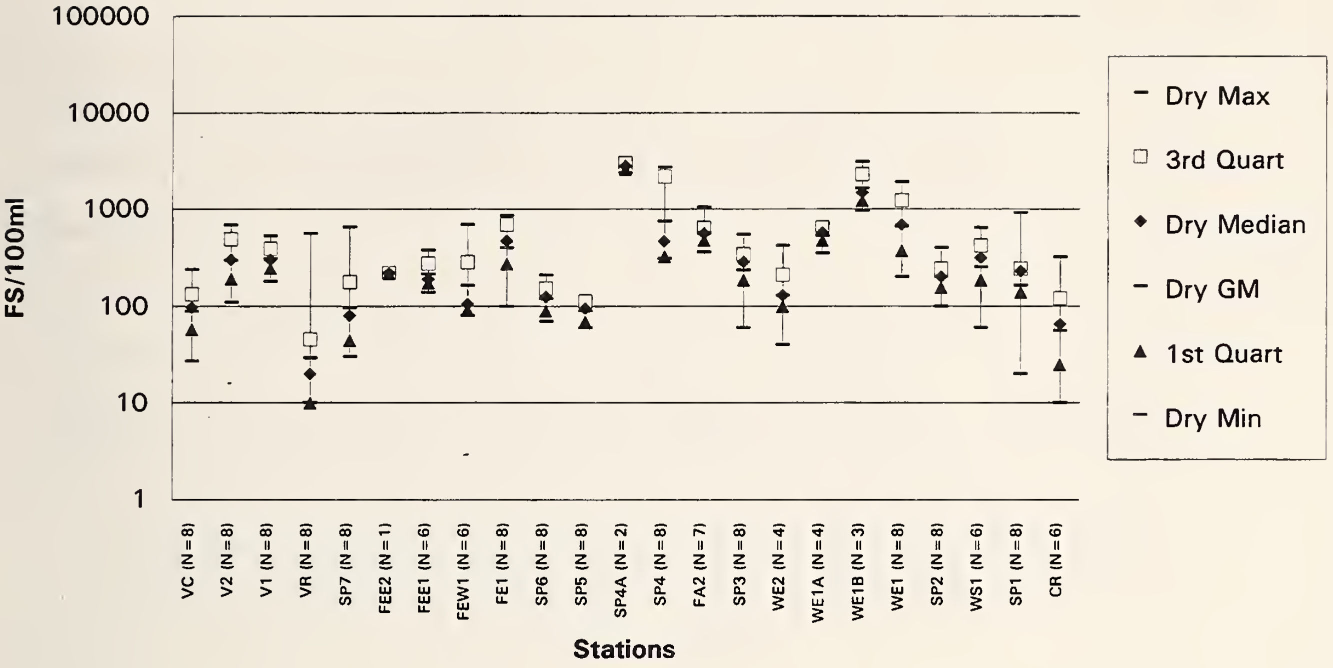


Spencer Creek WET Weather Sampling
E. COLI Concentrations

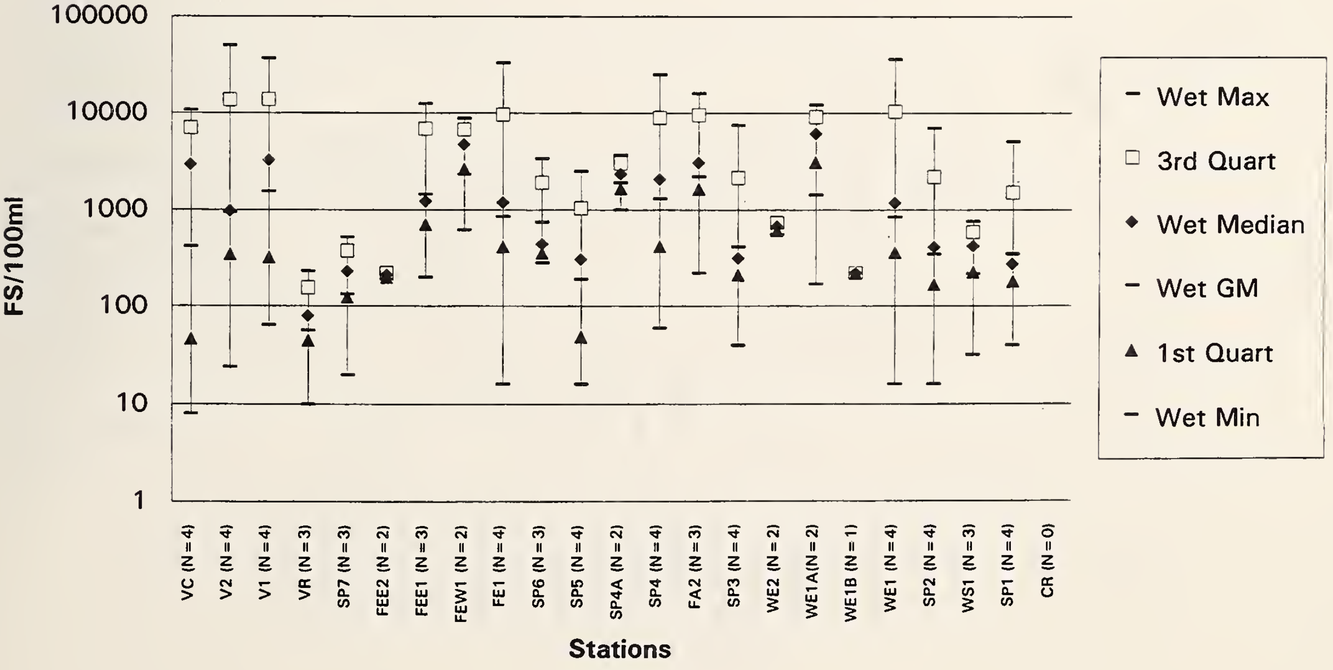


APPENDIX F

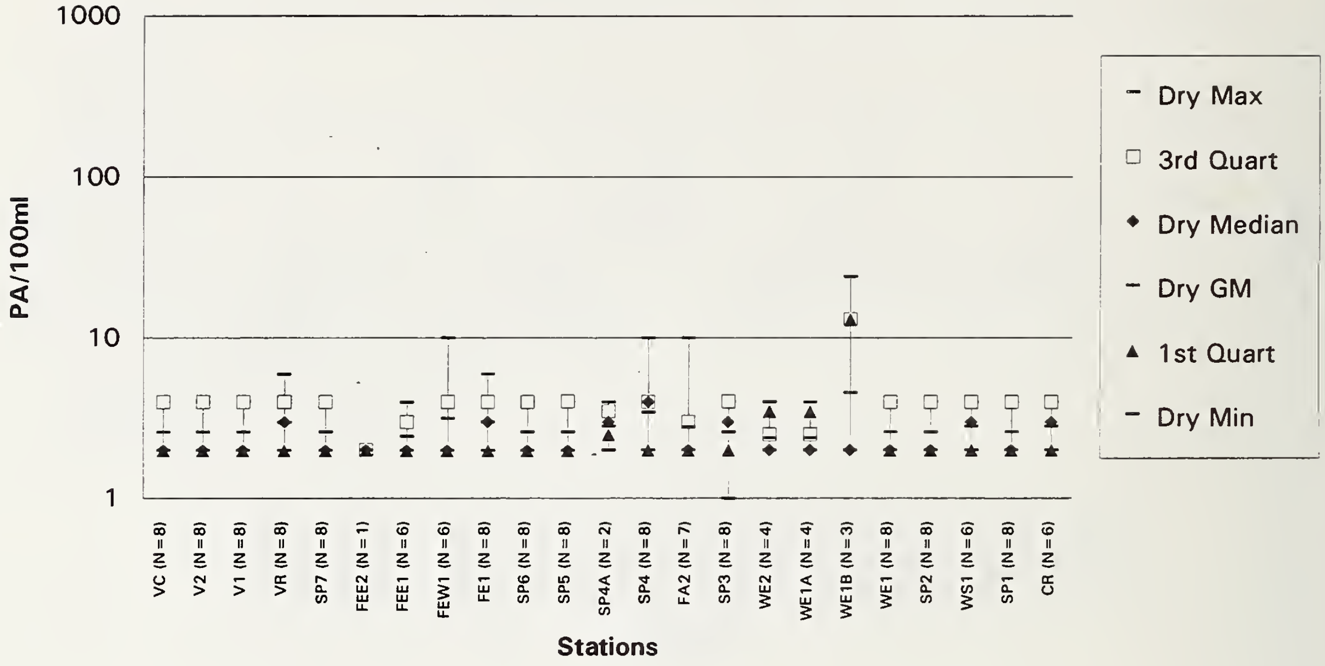
Spencer Creek DRY Weather Sampling
FECAL STREPTOCOCCI Concentrations



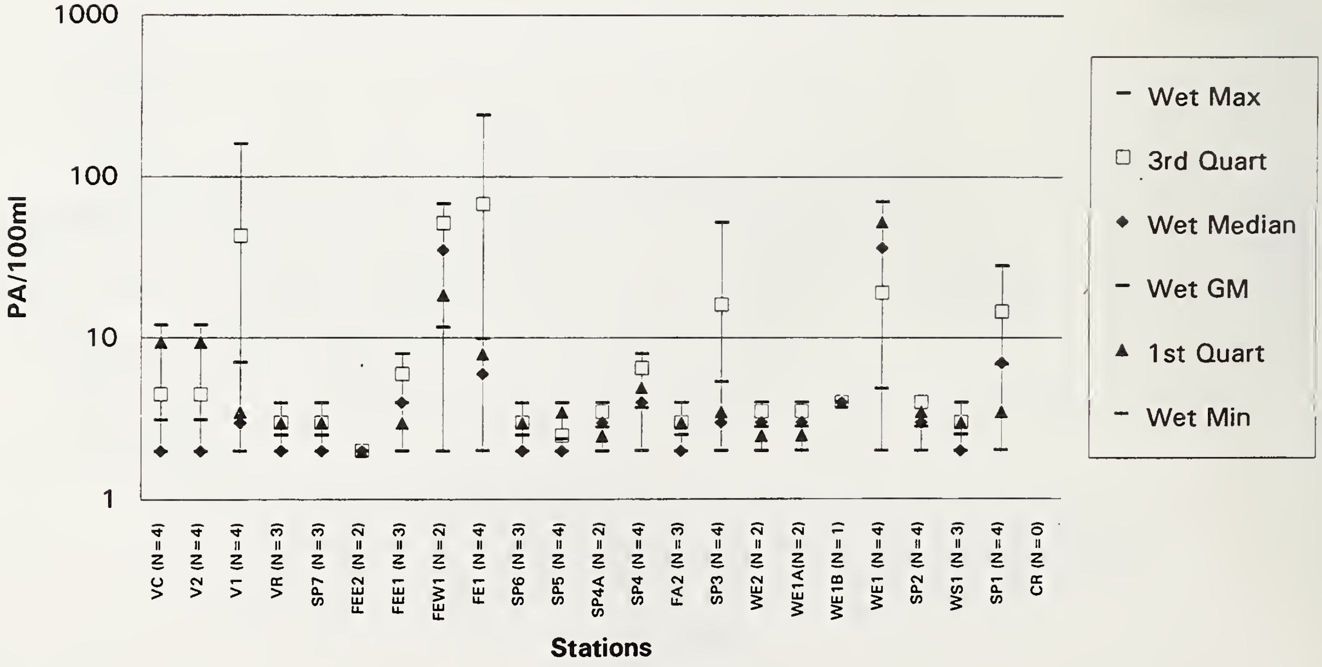
Spencer Creek WET Weather Sampling
FECAL STREPTOCOCCI Concentrations



APPENDIX F



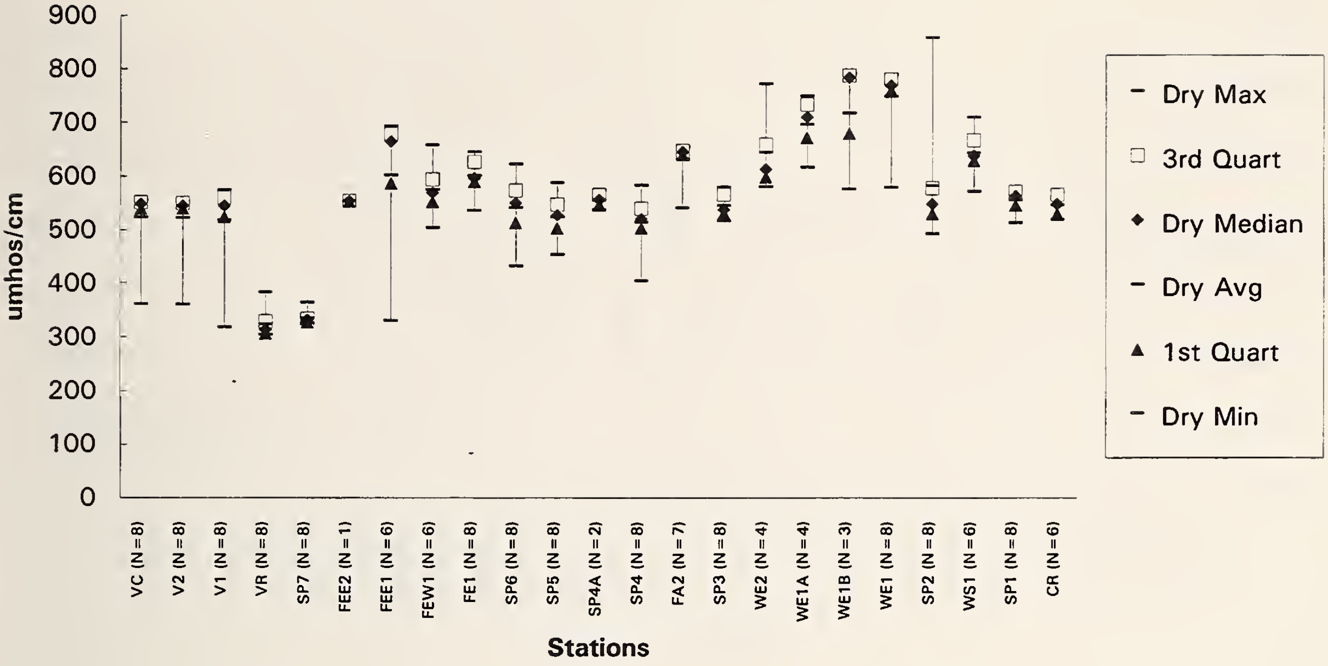
Spencer Creek DRY Weather Sampling
PSEUDOMONAS AERUGINOSA Concentrations



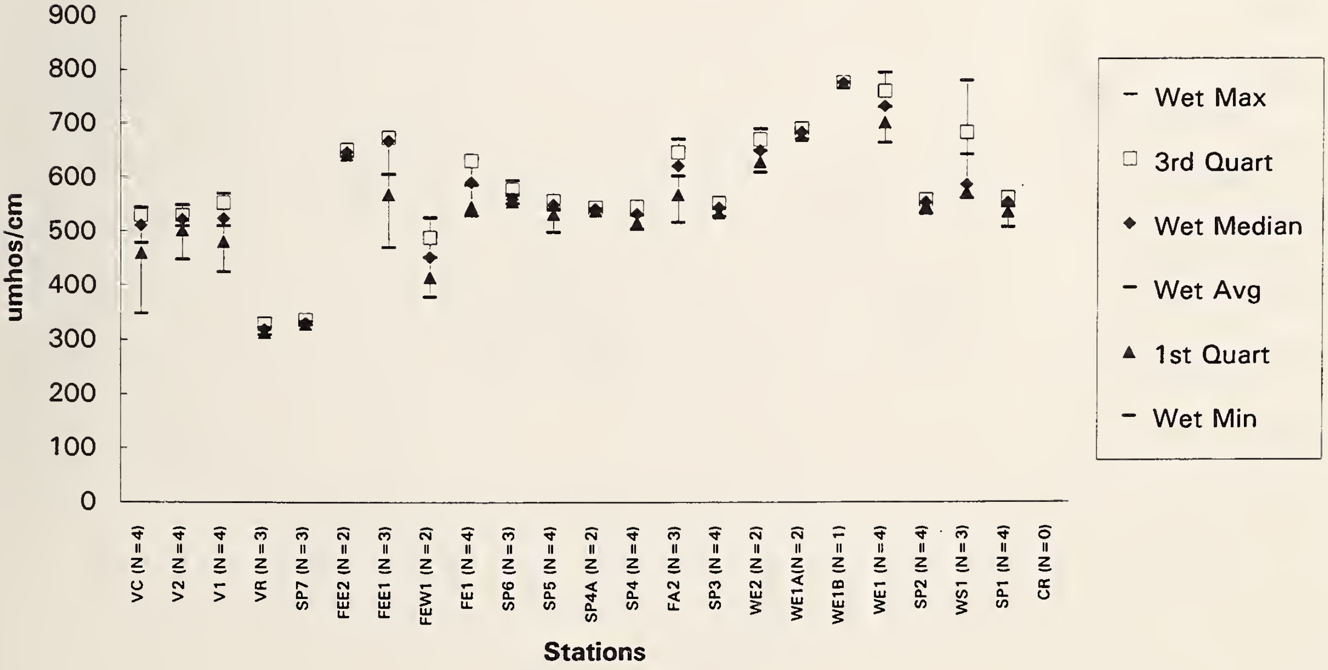
Spencer Creek WET Weather Sampling
PSEUDOMONAS AERUGINOSA Concentrations

APPENDIX F

Spencer Creek DRY Weather Sampling
CONDUCTIVITY Readings

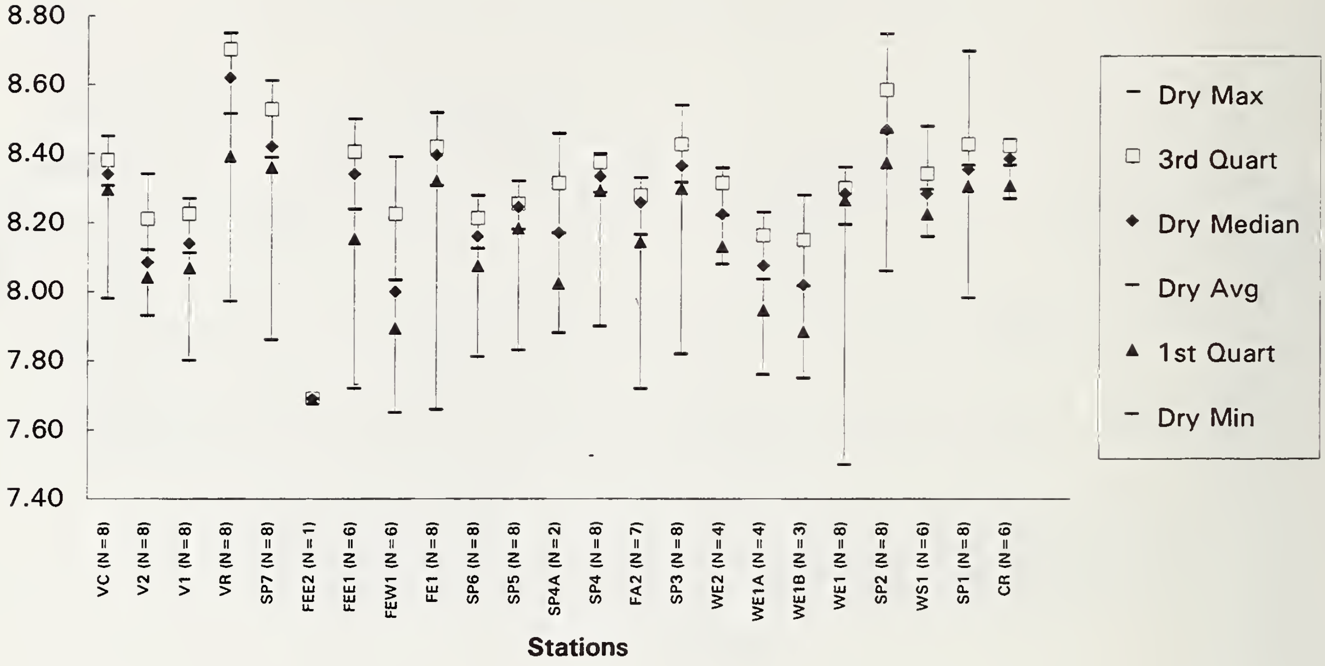


Spencer Creek WET Weather Sampling
CONDUCTIVITY Readings

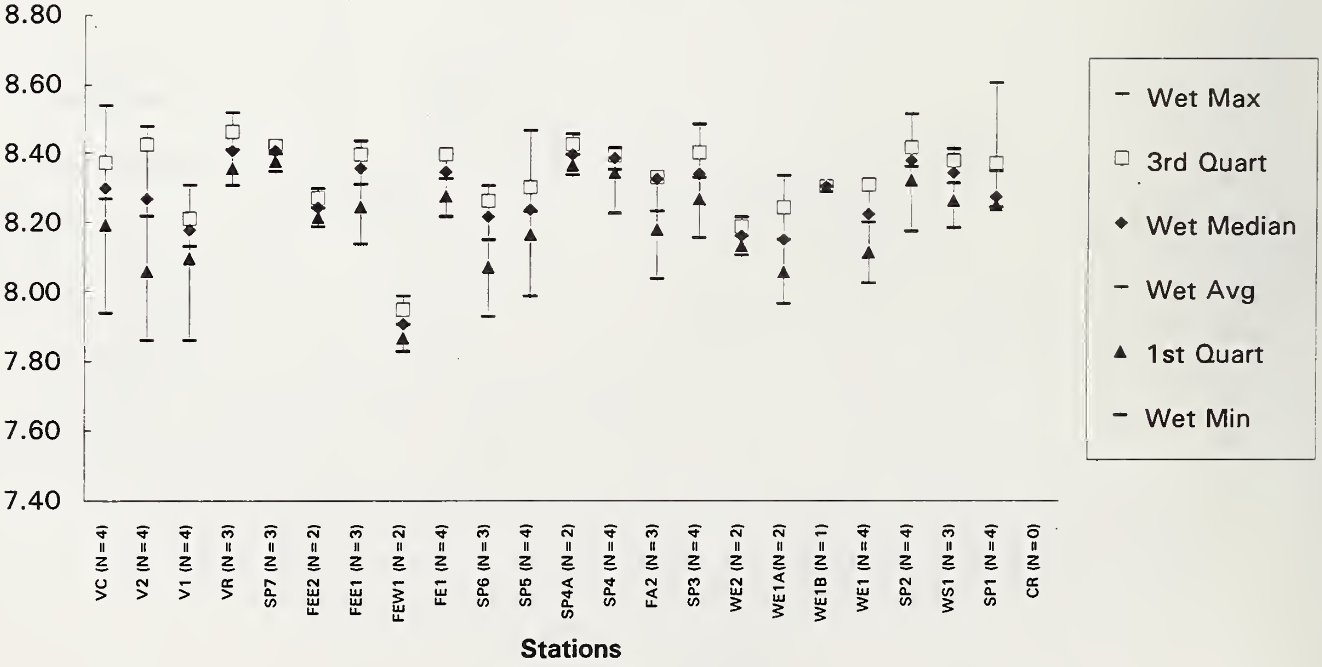


APPENDIX F

Spencer Creek DRY Weather Sampling
pH Readings

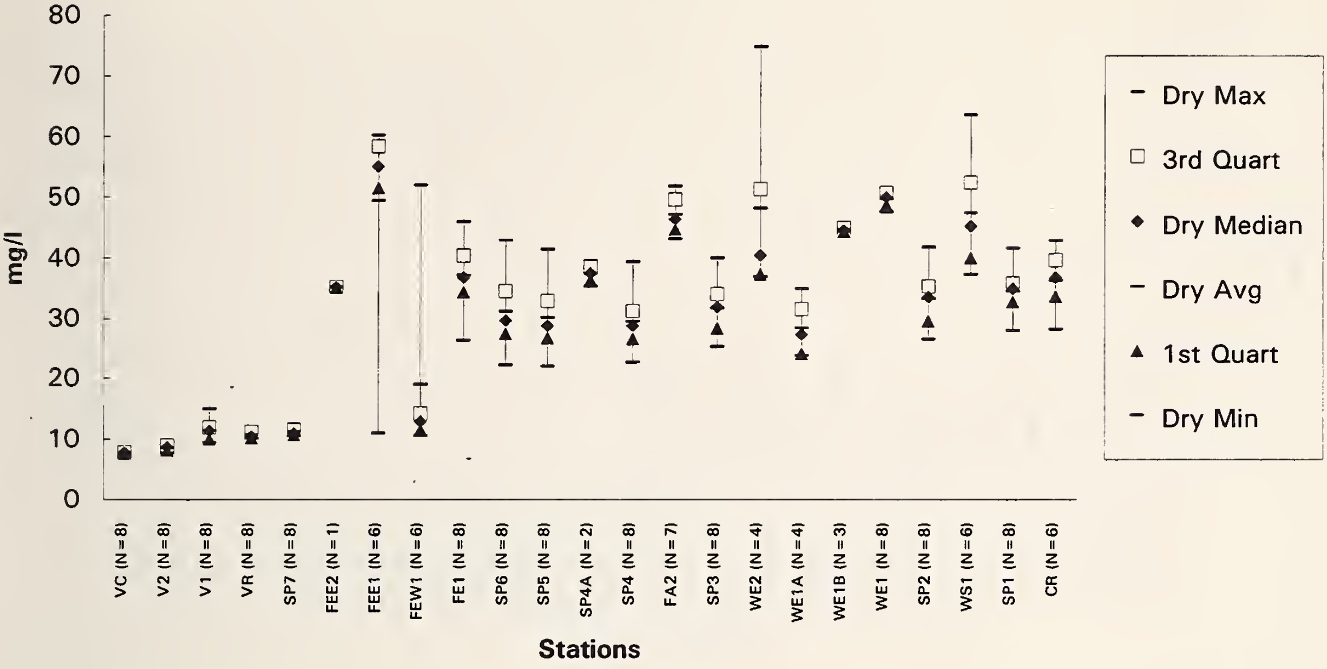


Spencer Creek WET Weather Sampling
pH Readings

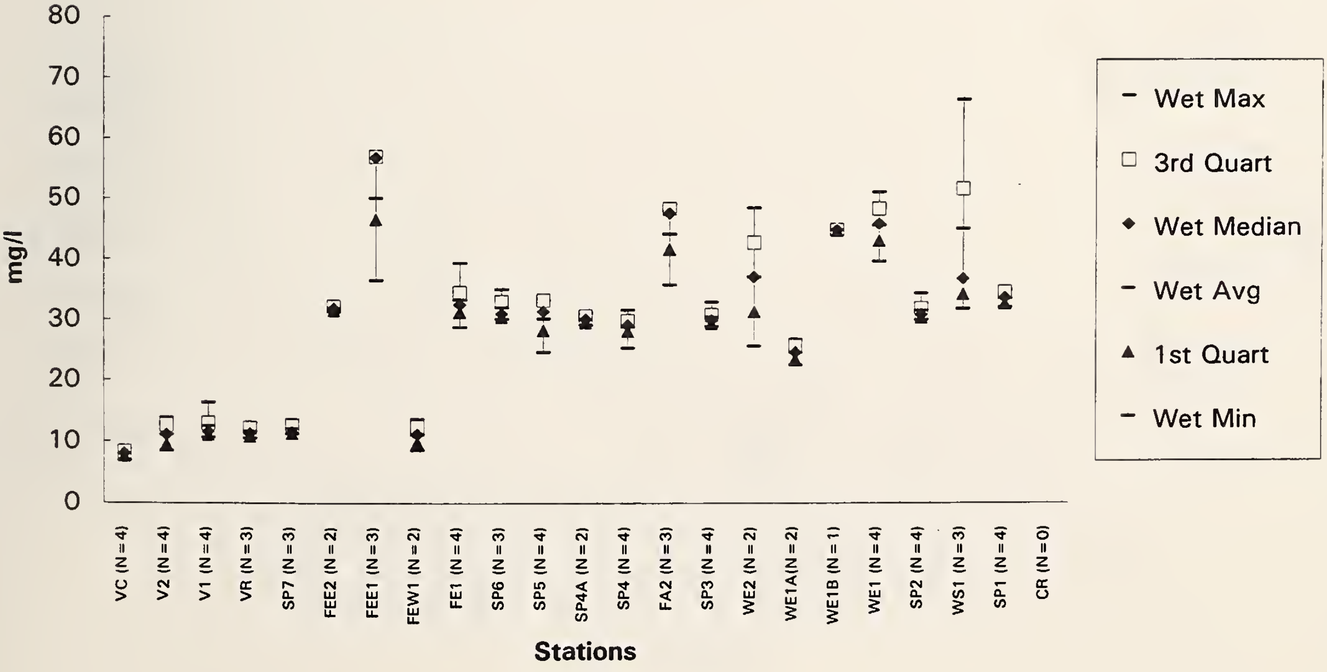


APPENDIX F

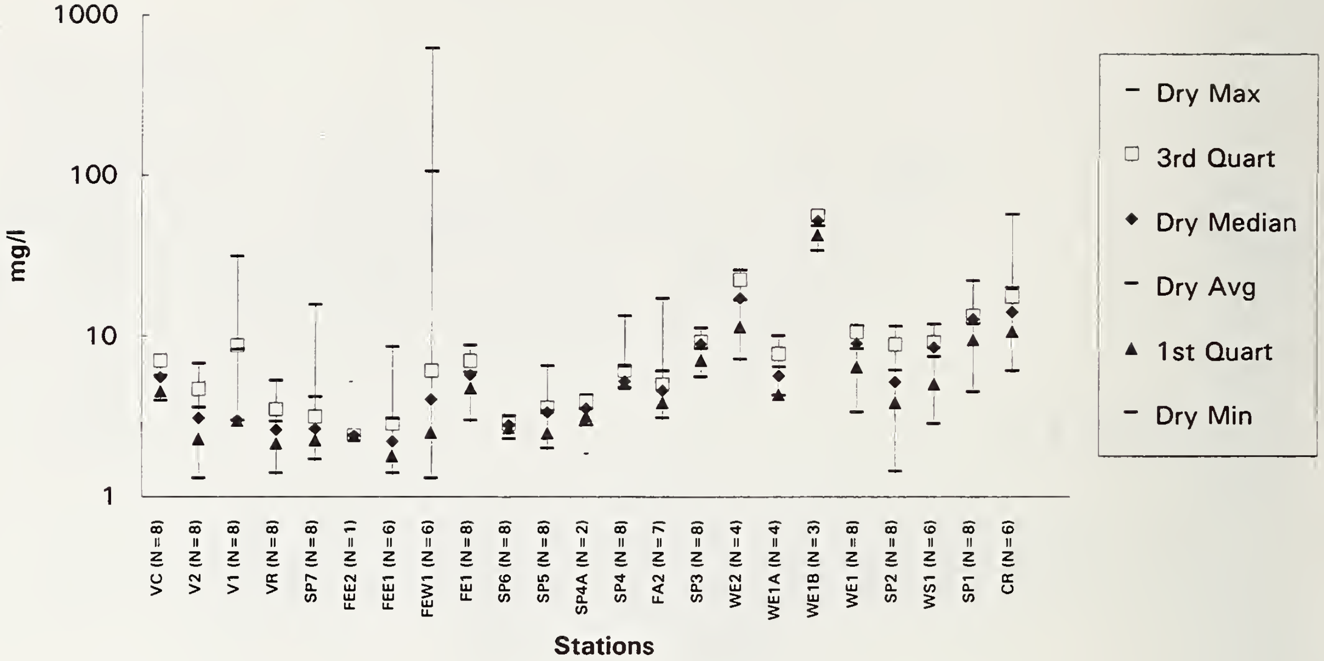
Spencer Creek DRY Weather Sampling
CHLORIDE Concentrations



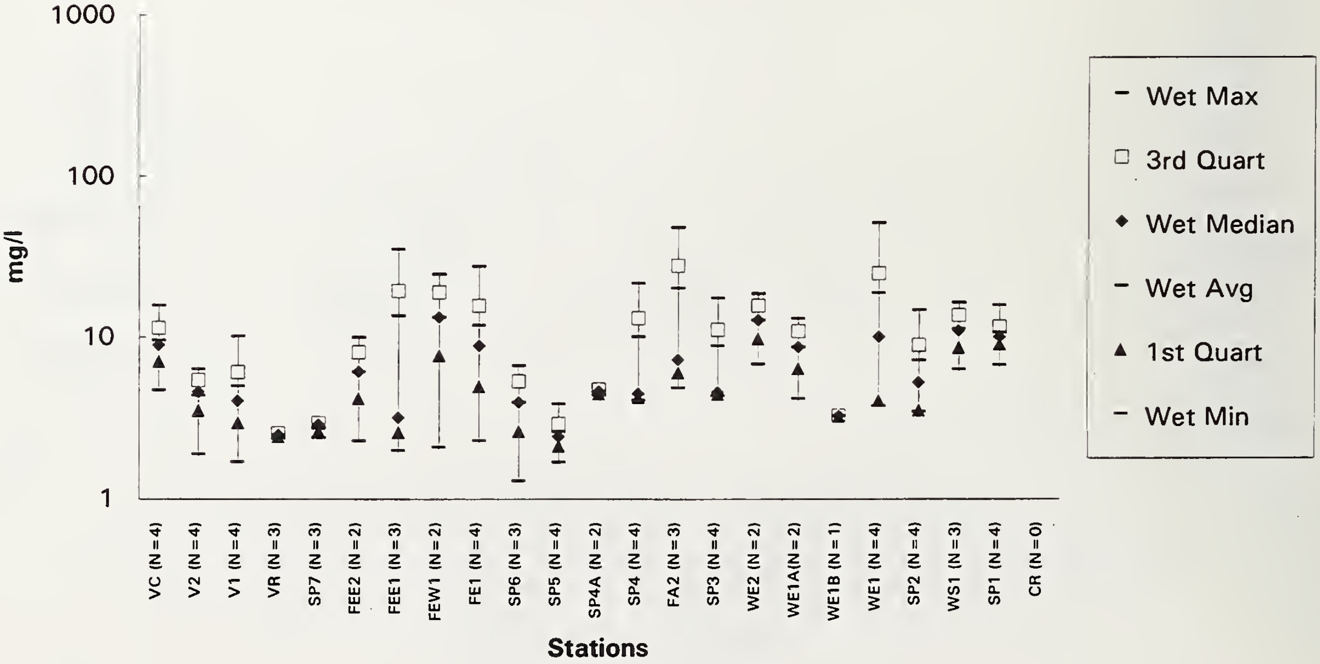
Spencer Creek WET Weather Sampling
CHLORIDE Concentrations



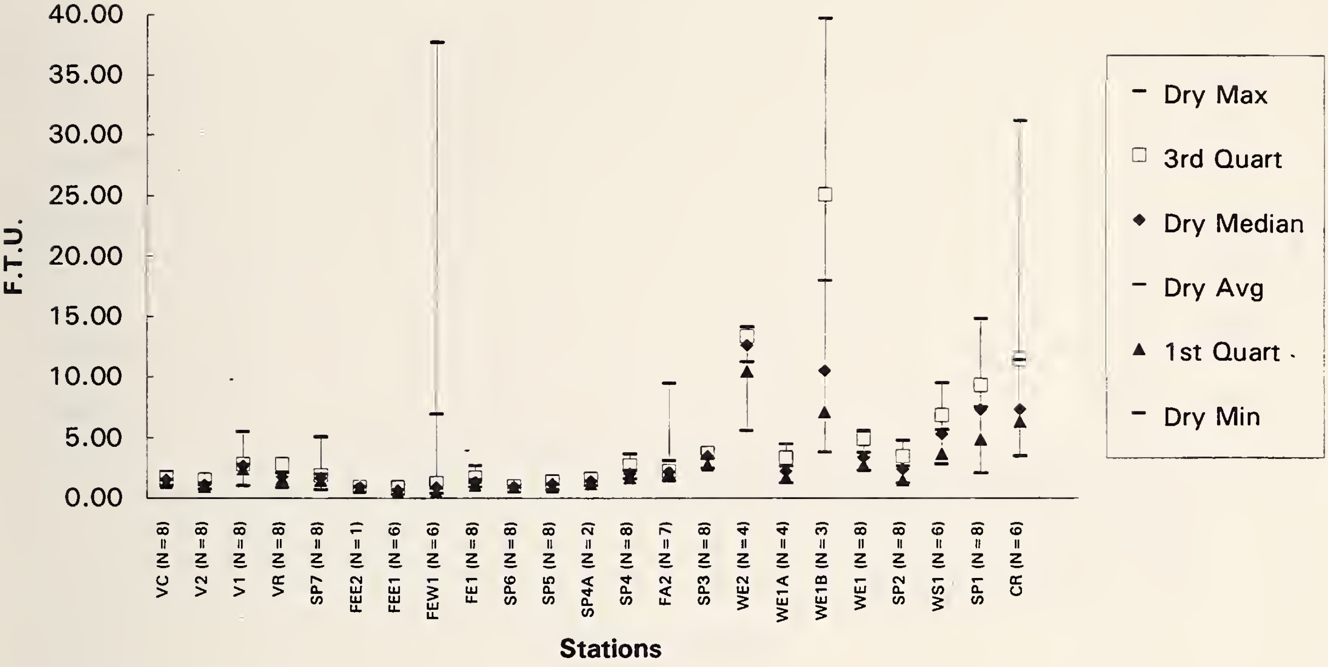
Spencer Creek DRY Weather Sampling
RESIDUE PARTICULATE Concentrations



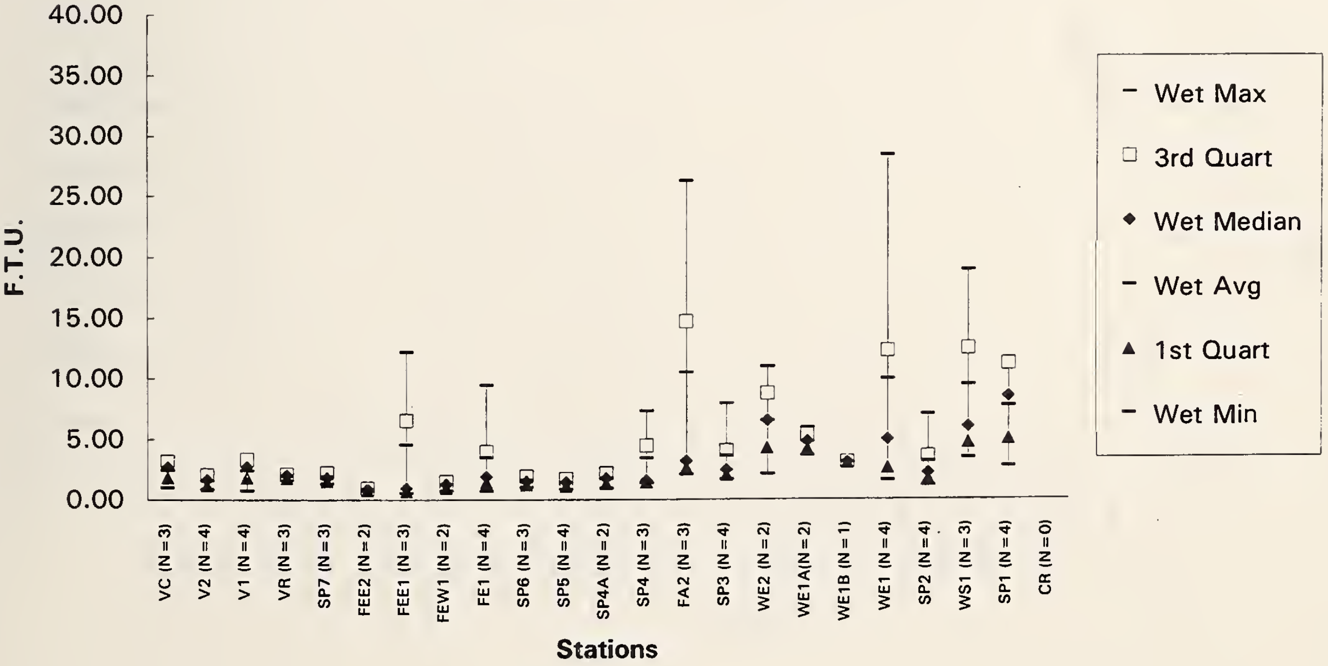
Spencer Creek WET Weather Sampling
RESIDUE PARTICULATE Concentrations



APPENDIX F



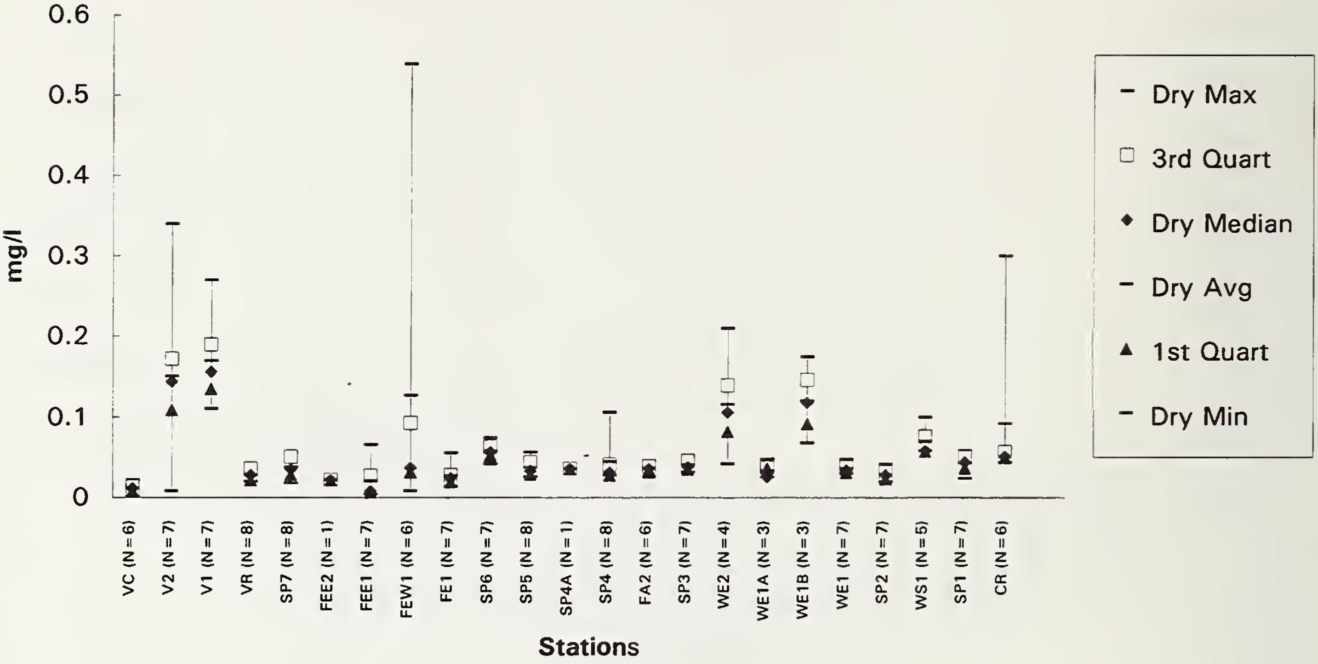
Spencer Creek DRY Weather Sampling
TURBIDITY Readings



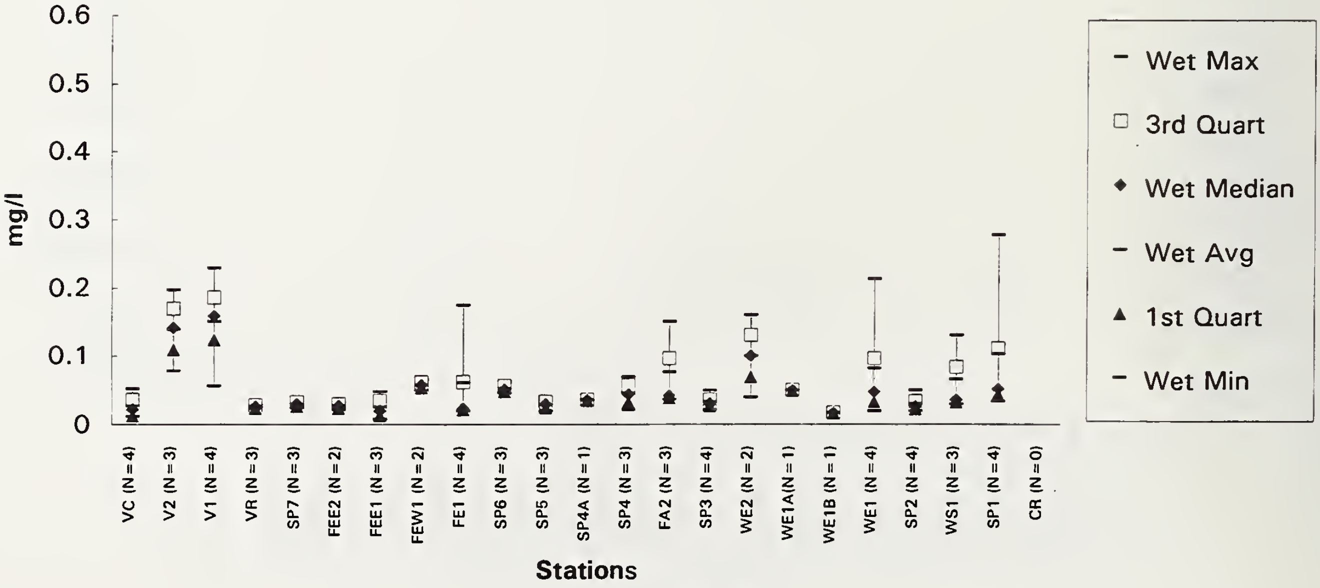
Spencer Creek WET Weather Sampling
TURBIDITY Readings

APPENDIX F

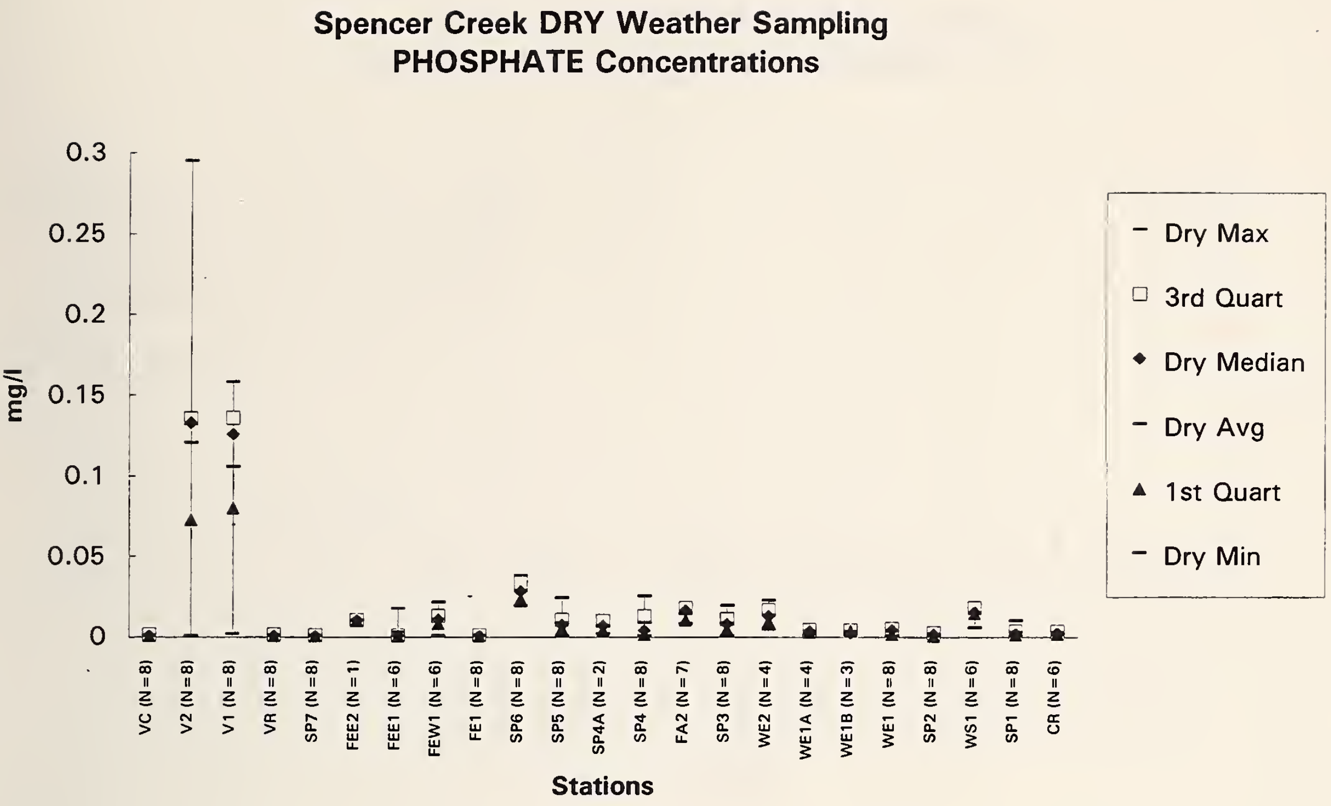
Spencer Creek DRY Weather Sampling TOTAL PHOSPHORUS Concentrations

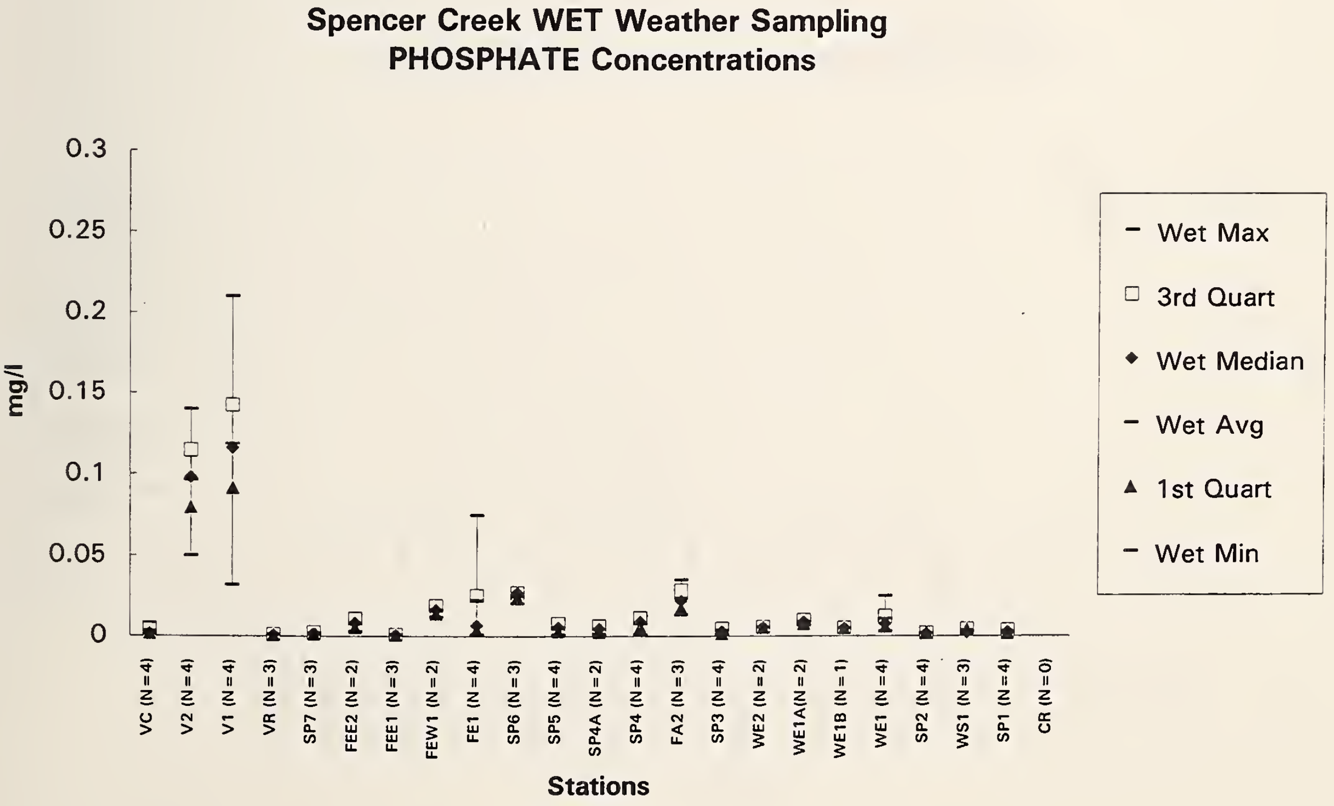


Spencer Creek WET Weather Sampling TOTAL PHOSPHORUS Concentrations



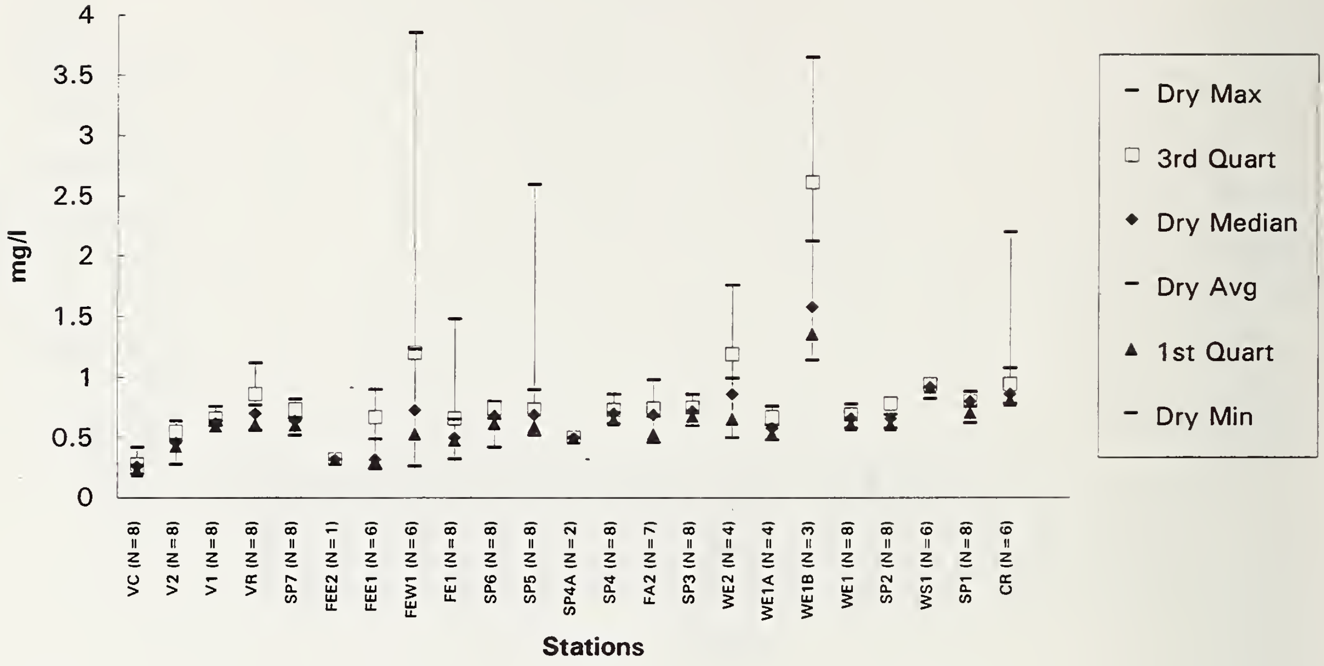
APPENDIX F


Spencer Creek DRY Weather Sampling
PHOSPHATE Concentrations
mg/l
0.3
0.25
0.2
0.15
0.1
0.05
0
VC (N=8)
V2 (N=8)
V1 (N=8)
VR (N=8)
SP7 (N=8)
FEE2 (N=1)
FEE1 (N=6)
FEW1 (N=6)
FE1 (N=8)
SP6 (N=8)
SP5 (N=8)
SP4A (N=2)
SP4 (N=8)
FA2 (N=7)
SP3 (N=8)
WE2 (N=4)
WE1A (N=4)
WE1B (N=3)
WE1 (N=8)
SP2 (N=8)
WS1 (N=6)
SP1 (N=8)
CR (N=6)
Stations
Dry Max
3rd Quart
Dry Median
Dry Avg
1st Quart
Dry Min

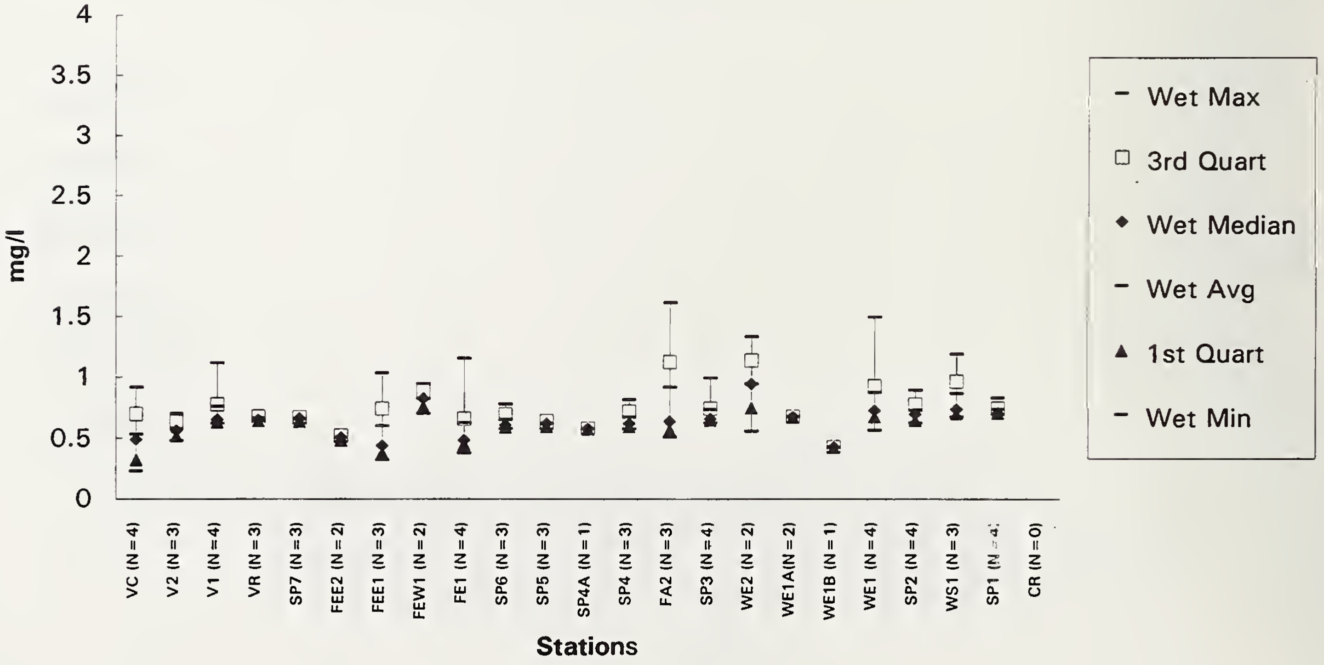

Spencer Creek WET Weather Sampling
PHOSPHATE Concentrations
mg/l
0.3
0.25
0.2
0.15
0.1
0.05
0
VC (N=4)
V2 (N=4)
V1 (N=4)
VR (N=3)
SP7 (N=3)
FEE2 (N=2)
FEE1 (N=3)
FEW1 (N=2)
FE1 (N=4)
SP6 (N=3)
SP5 (N=4)
SP4A (N=2)
SP4 (N=4)
FA2 (N=3)
SP3 (N=4)
WE2 (N=2)
WE1A(N=2)
WE1B (N=1)
WE1 (N=4)
SP2 (N=4)
WS1 (N=3)
SP1 (N=4)
CR (N=0)
Stations
Wet Max
3rd Quart
Wet Median
Wet Avg
1st Quart
Wet Min

APPENDIX F

Spencer Creek DRY Weather Sampling
TOTAL KJELDAHL NITROGEN Concentrations

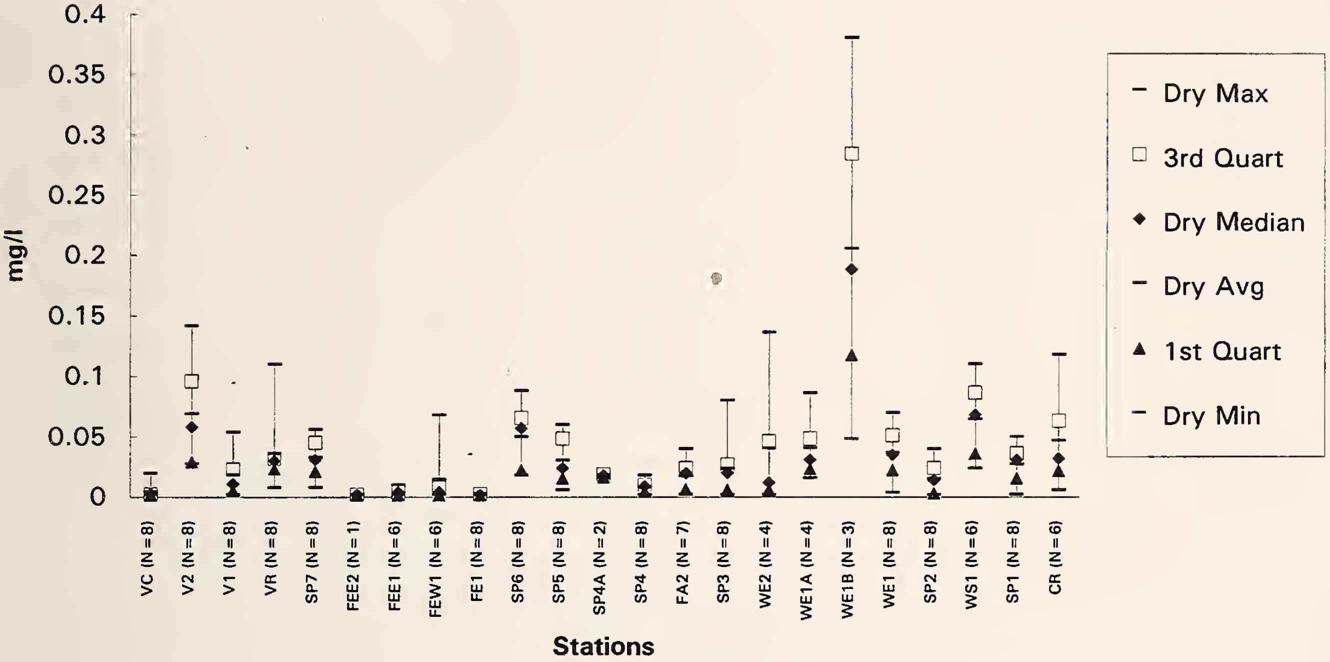


Spencer Creek WET Weather Sampling
TOTAL KJELDAHL NITROGEN Concentrations

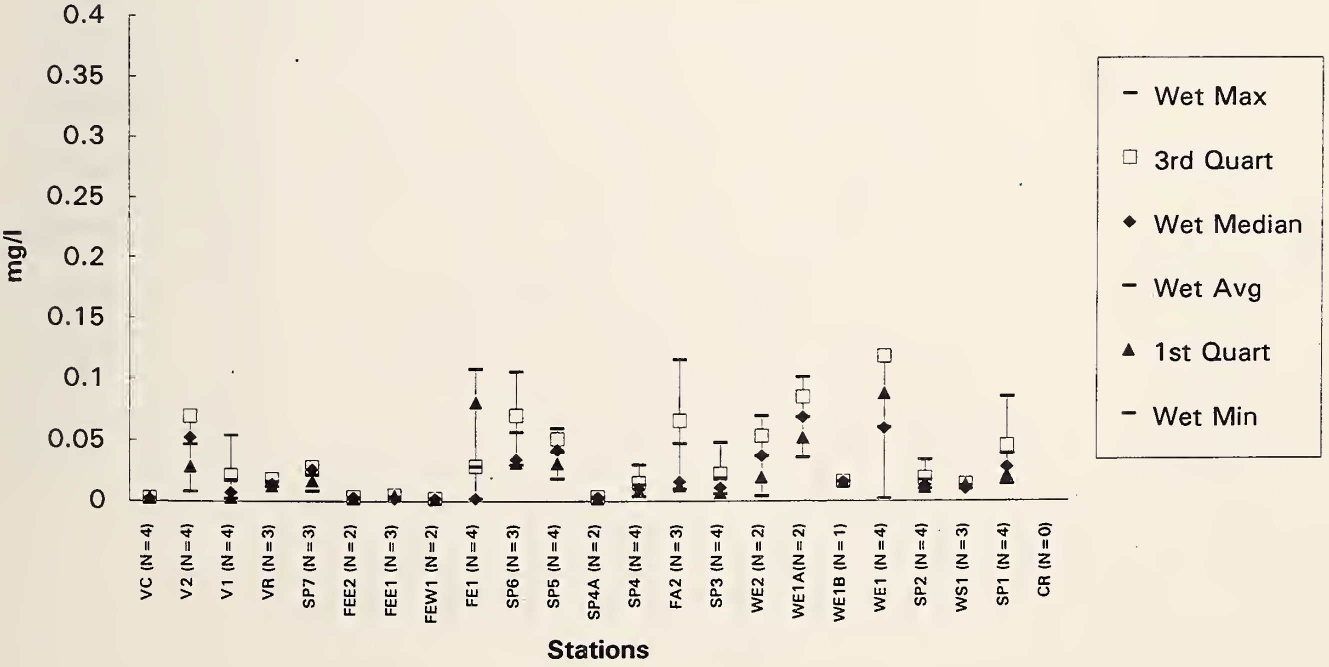


APPENDIX F

Spencer Creek DRY Weather Sampling
AMMONIUM Concentrations

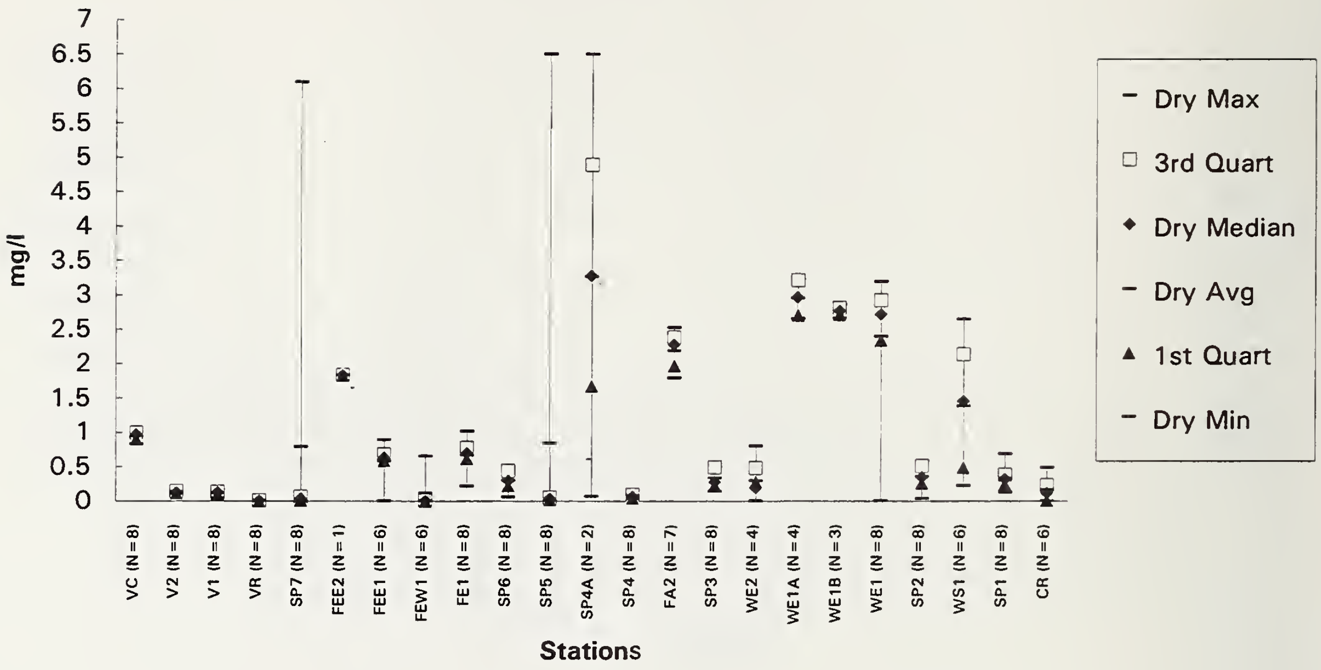


Spencer Creek WET Weather Sampling
AMMONIUM Concentrations

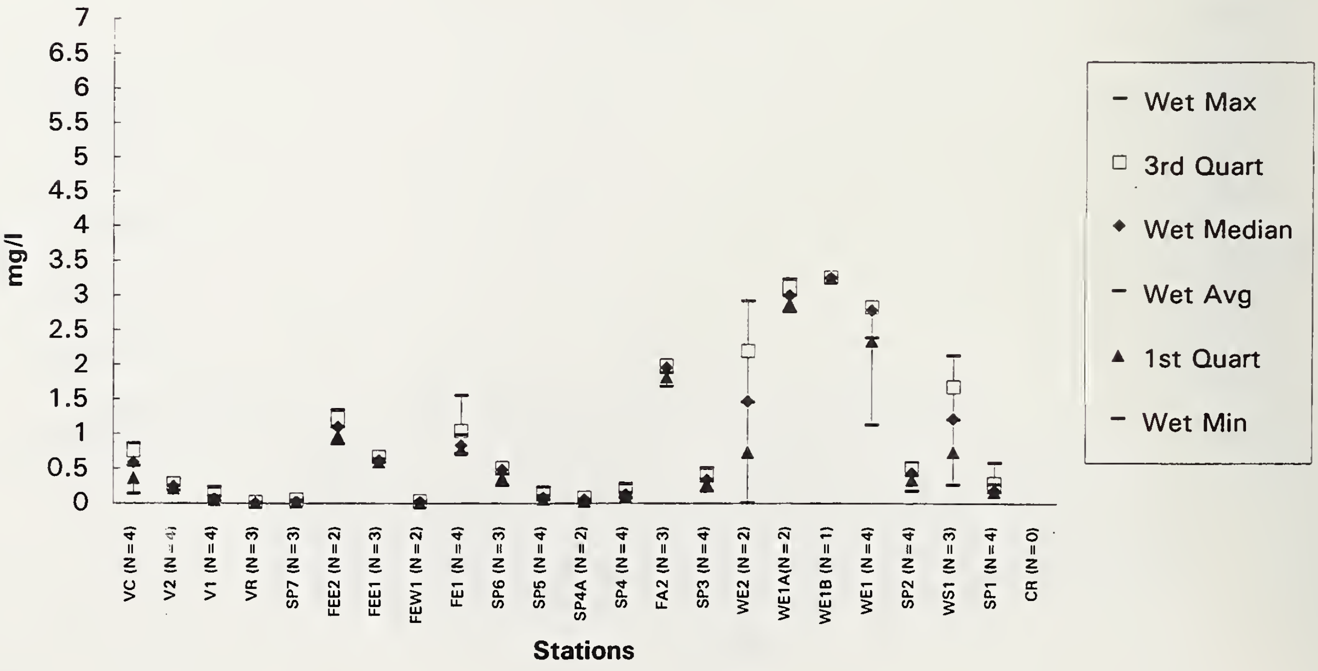


APPENDIX F

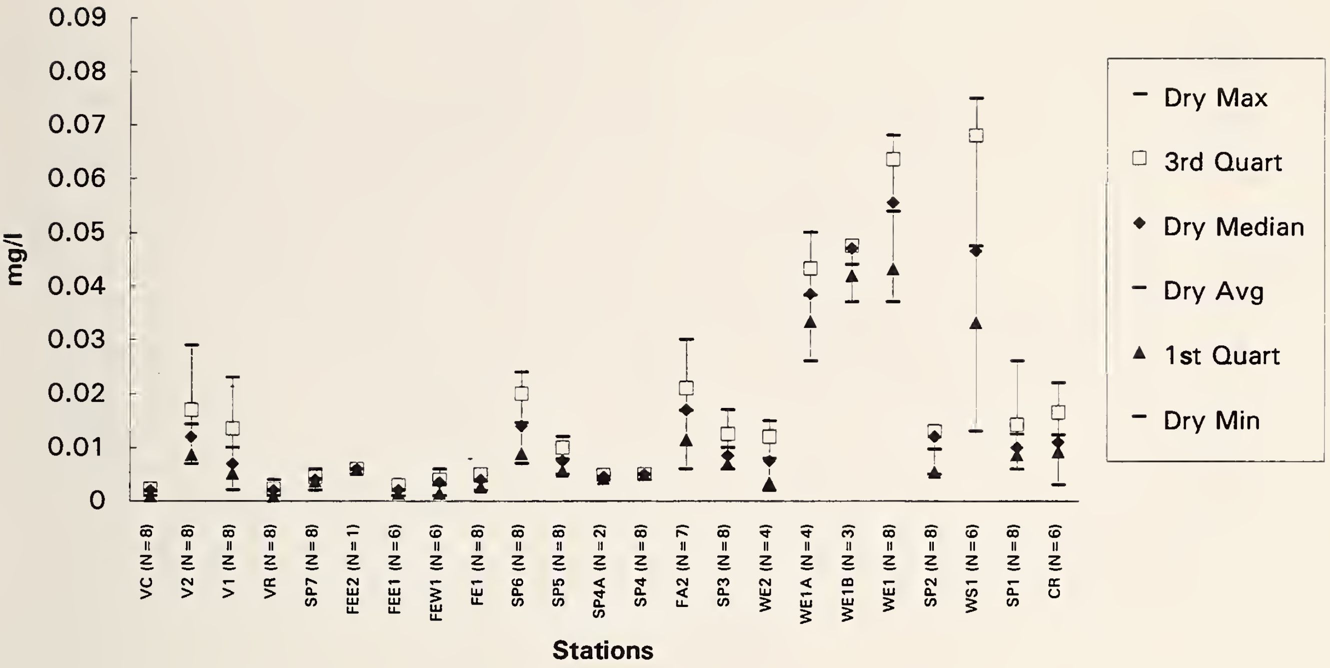
Spencer Creek DRY Weather Sampling NITRATE Concentrations



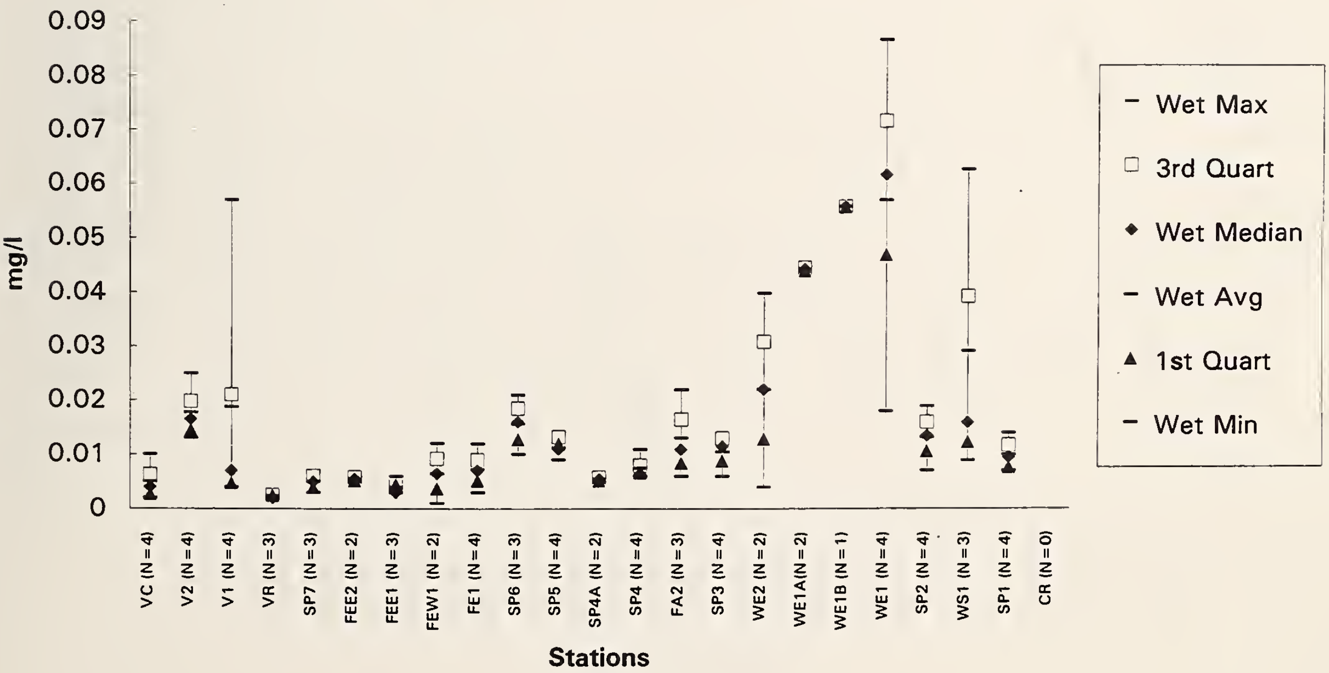
Spencer Creek WET Weather Sampling NITRATE Concentrations



APPENDIX F



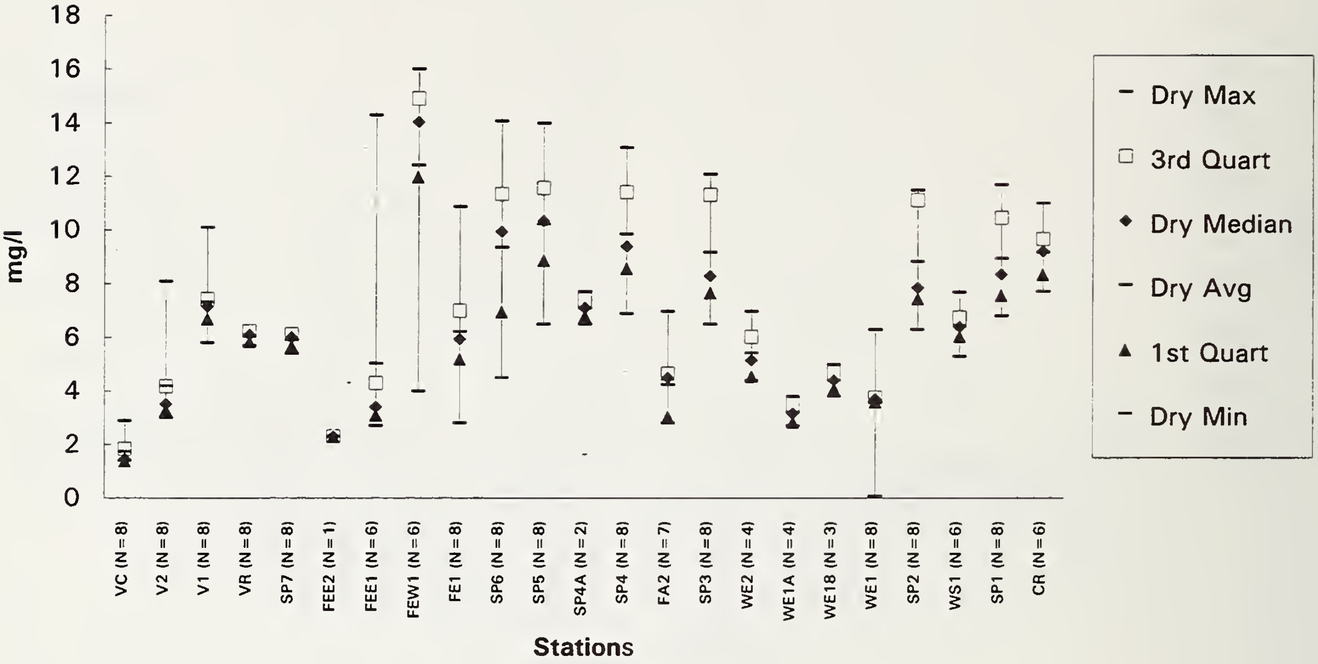
Spencer Creek DRY Weather Sampling
NITRITE Concentrations



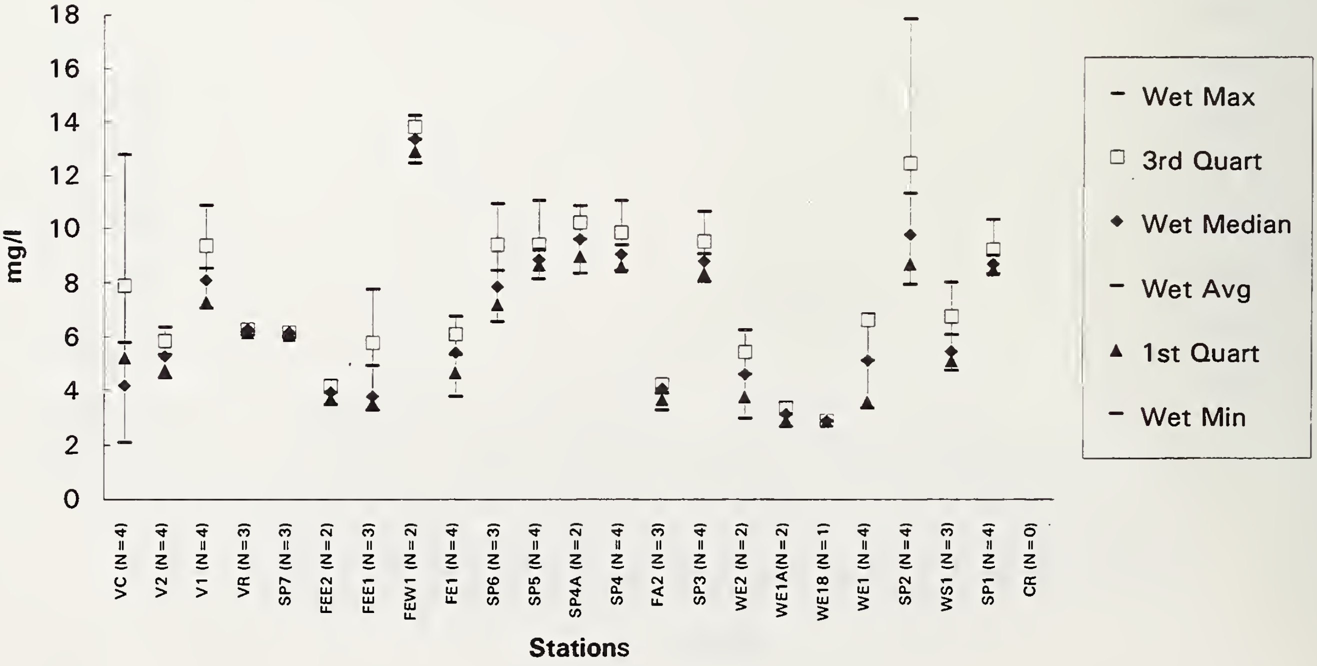
Spencer Creek WET Weather Sampling
NITRITE Concentrations

APPENDIX F

Spencer Creek DRY Weather Sampling
DISOLVED ORGANIC CARBON Concentrations



Spencer Creek WET Weather Sampling
DISOLVED ORGANIC CARBON Concentrations



APPENDIX G

Press Clippings

Spencer Creek is going green

Dye added to track bacteria

By **MARTHA JETTE**
Staff Writer

Spencer Creek turned green — but only for about 24 hours last week.

Bruce Duncan, an ecologist with the Hamilton Region Conservation Authority, said a green dye was added to the water in Spencer Creek where the creek crosses Highway 5 just west of Waterdown.

By tracking the harmless dye, HRCA staff can determine how bacteria flows toward Christie and Valens conservation areas.

"We'll see how it moves into the Christie (and Valens) reservoir and how it affects the swimming beach," said Mr. Duncan.

He added that Dundas residents likely won't notice any change of color in the section of the creek that flows through town, as the dye will dissipate before it gets that far.

'We're not interested in the flow below Christie," he said.

The project was conducted with staff assistance, expertise and funding from the Halton Region Conservation Authority. The Halton authority is conducting a similar experiment on Sixteen Mile Creek.

CURB program

The results of the findings will be issued in reports to the Ministry of the Environment and Ministry of Energy. The [illegible] will provide funding for remedial cleanup of the waterways under a new Clean Up Rural Beaches program.

David Gale of the Halton authority said putting the dye in Spencer Creek is actually a small part of a much larger study of the entire watershed that runs from Valens south through Dundas via Spencer Creek and down to Hamilton Harbor. More than [illegible]0 water samples have also been taken.

"There are concerns that there may be a significant amount of bacteria in the watershed," he said.

When levels of bacteria or other pollutants become too high, it begins to affect plant and animal life, and also limits swimming in the area, he said. While Christie and Valens have cordoned off swimming areas that are regularly chlorinated, Mr. Gale said doing so is expensive.

"We would like, if possible, to eliminate that," he said.

Green dye project aimed to clean up Spencer Creek

By Lori-Anne Kersten
Reporter, Flamborough Review

Large blobs of green dye were floating down Flamborough's Spencer Creek this week at a part of an effort to clean up the Hamilton Harbour by the Hamilton Region Conservation Authority (HRCA).

The dye, added periodically over a two week period, is being used as a flourescian sodium technical dye to track the pattern flow and the flow of the water course. The dye is harmless and dissipates after 24 hours.

"Basically we are seeing how long it takes for water to flow from point A to point B and the bacterial pollution it brings with it, said David Gale of the Halton and Hamilton conservation authorities. By examining the patterns and flow, the authority will be able to determine the time it takes for pollutants to arrive at certain points, namely Christie and Valens Conservation Area.

Other studies over the course of the summer include a sediment and erosion study, fish habitat study and aerial studies to "allow for the healthiest watershed possible," said Gale.

Based on the results of the study, the HRCA will send a report to the Ministry of Environment and Energy for potential participation in the Ministry's CURB (Clean Up Rural Beaches) program. If accepted, the authority will be eligible for funding for the MOEE to provide for remedial programs that will clean up the watercourse.

If funding is provided, landowners will be given money to improve their land surrounding the creek (such as fences).

Slater
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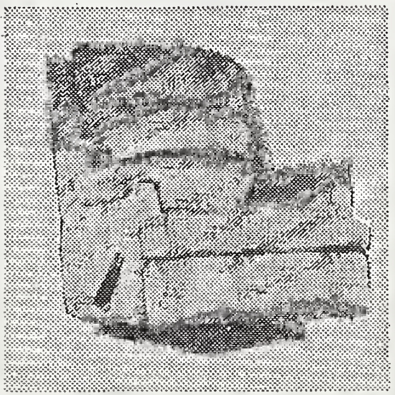

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